Journal of American Science

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MARSLAND PRESS
Multidisciplinary Academic Journal Publisher

# Managerial Requirements of Tehran Vision in 2025: How Can DSS Help?

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**Abstract:** Along with the vision of Iran in 2025, the Tehran's vision with focusing on 8 main categories is also documented by Tehran City Council. The categories emphasize on different aspects of Tehran, from its economy, transportation and infrastructures to the environment, security and social affairs. This diversity of issues made it difficult for authorities to move towards Tehran's vision by effective planning. As a result, they need useful tools to support them overcoming the complexity of decision making process. Decision support systems are one of the effective tools used worldwide to help deciding about urban infrastructures and facilities, due to the fact that they improve the quality of planning process and made it possible to use advanced analysis and modeling tools. The aim of this paper is to clarify how DSS could empower the authorities of Tehran to move towards its vision by introducing the areas of Tehran Vision which DSS could come in handy to facilitate the process of decision making.
[Masood Saadatmand, Samira Fallah, Farzad Torkamani. **Managerial Requirements of Tehran Vision in 2025: How Can DSS Help?** *J Am Sci.* 2021;17(7):15-23]. (ISSN: 1545-1003). http://www.americanscience.org. 2. doi:10.7537/marsjas170721.02.

**Key words:** Decision Support Systems, Tehran vision 2025 (1404), Urban Management, Decision Making, Iran vision 2025 (1404)

## 1. Introduction

Urban management concerns about planning, development and day-to-day operations of a city. Effective urban management requires the involvement of both public and private sectors to regulate, improve, and maintain urban infrastructures. Today, annual growing of population in urban areas leads to new problems in cities, such as:

- Growing traffic congestion while increasing demand for smooth and safe mobility
- More energy consumption
- Increasing demand for necessary supplies such as water, fuel, electricity and etc.
- More air and noise pollution
- Increasing demand for different facilities and services

As the result, cities must have sufficient capacity for the growing inhabitants and be prepared to fulfill their requirements by necessary infrastructures like transportation systems, sewage system, garbage gathering and treatment system, water and energy supply systems as well as other facilities. This would be possible through rethinking about the current infrastructures while planning for new facilities and systems which arises the need for efficient decision making and scenario formulating.

But it should be noticed that in the area of city logistics and urban management, the decision making space has some sort of complexity, as there are various, sometimes conflicting, aspects and problems to be dealt in different levels.

Table *1* summarizes the specifications of different level decisions with introducing typical examples in a city.

Table 1-Different levels of decisions in cities

| Decision Level | Decision Makers | Description | Instances in urban area |
|---|---|---|---|
| Strategic | Senior Managers | Long-term programs and large scale projects | • Building a new airport,<br>• Designing the waste water treatment system |
| Tactical | Mid-Level Managers | Middle-term decisions | • Building a traffic light,<br>• Alter the ways from two-way to one way |
| Operational | Operational Managers | Real-time decisions | • Changing the timing of a traffic light,<br>• Controlling the traffic flow of a highway,<br>• Controlling the garbage gathering using GPS |

Due to the complexity of decision making in urban management, the authorities should have effective tools to support them while deciding about different aspects of cities. They need a tool that improve the quality of planning process and allow the use of advanced analysis and modeling.

Recently, advances in information technology made information systems useful, productive and economical tools to facilitate decision making process and reducing the complexity. There are different types of information systems with application in different situations, for instance transaction processing systems (TPS) are used to support operational managers while executive information systems (EIS) are helpful for senior managers and decision support systems (DSS) could be applied to facilitate the process of making decisions in different levels of a system from strategic to operational and tactical levels.

As the result, we believe that DSSs could be useful for urban planning and management, as their main functionality is to help decision makers with providing information and decision support techniques to analyze specific problems or opportunities. This issue is also emphasized in researches and studies as there are several studies in current literature which address the application of DSS in managing cities.

This paper discusses the role of DSS in solving complex problems in urban areas with emphasizing on the areas in which it can be applied by the authorities through the way to Tehran vision of 2025.

To find out what dimensions DSS helps to manage the urban areas more productively, a research-oriented process is traced as shown in

Figure *1*. Clearly, the first three steps, has taken through the city council of Tehran and the fourth and fifth ones are covered in this paper.

The rest of this paper is organized as the following: Section 2 presents a descriptive introduction to information system development trends, information systems types and specially DSS. In Section 3, we review Tehran vision of 2025 briefly and section 4 is dedicated to introducing the areas in which DSS could be used and how it is helpful to achieve the objective of each area. Finally in section 5 and 6 we summarize the achievements of the paper by some recommendations and paper conclusion.

## 2. A review of Decision Support systems

To have a broader view of a DSS it is helpful to define it; “decision support systems are computer-based systems that provide interactive information support to managers and business professionals during the decision making process” (O'Brien, 2004)

Basically, a DSS has 4 essential components (Burstein & Holsapple, 2008) as the following (shown in Figure 2):

- Language system, consisting of the messages the DSS can accept
- Presentation system, which is made up of the messages the DSS can release

- Knowledge system, consisting of the knowledge the DSS has stored and retained
- Problem-processing system, the DSS's software engine which tries to recognize and solve problems

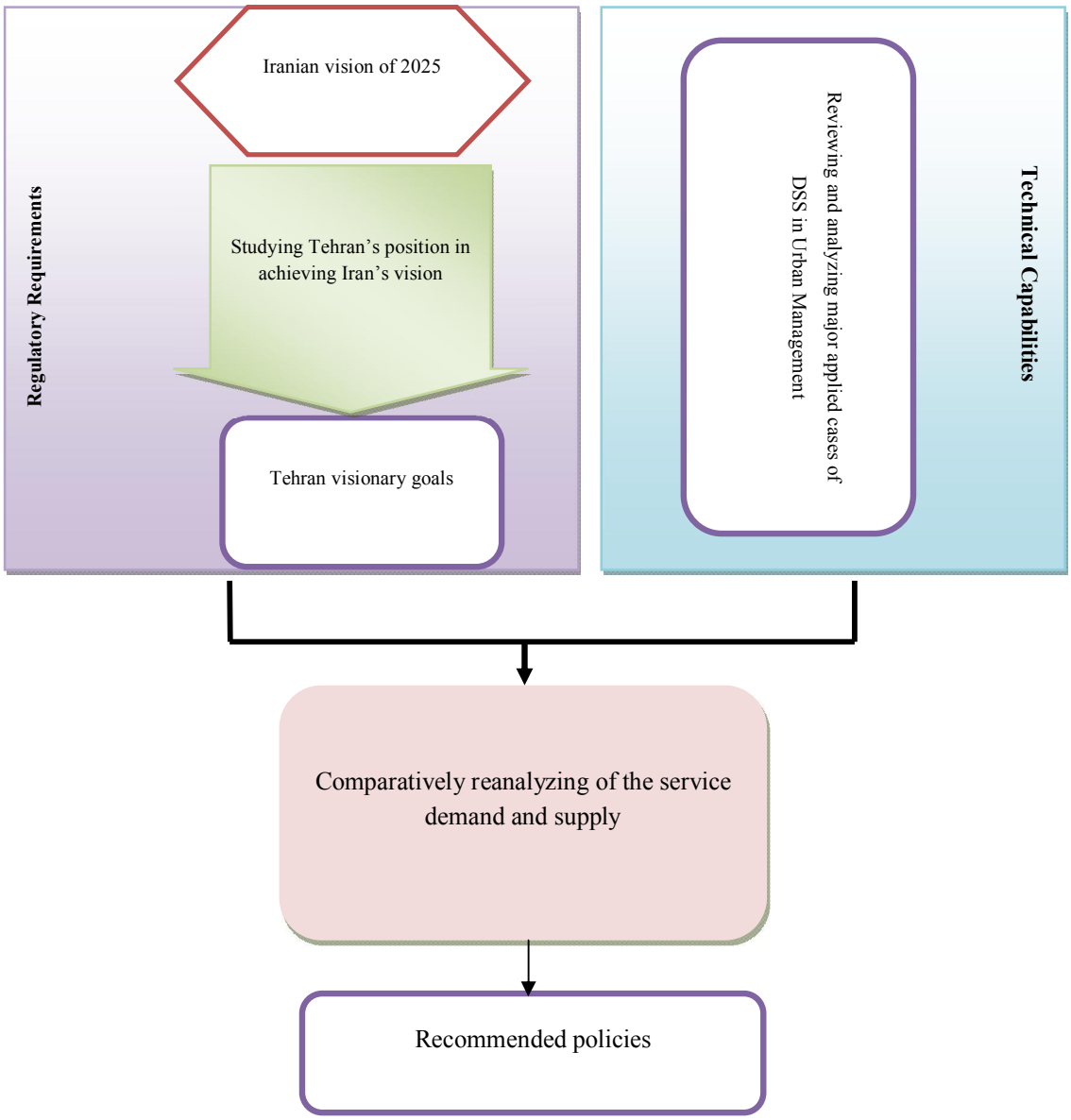


Figure 1- Research model

One of the important parameters for making effective decisions is the appropriateness of information. Up-to-date, accurate, relevant, comprehensive and clear information is required to ensure suitable out-puts. Accessing to this type of information in urban areas is facilitated by using Geographic Information Systems (GIS) and Global Positioning Systems (GPS).

GIS is often defined as an information system which is capable of data capturing, data storage, data management, data retrieval, data analysis and data displaying. The data which is processed in GIS is often geographically-referenced (Nag & Sengupta, 2007) As a result, with utilizing GIS, practitioners are able to view, understand, question, interpret, and visualize data in many ways revealing relationships, patterns, and trends in form of maps, globes, reports, and charts.

GIS helps to answer questions and solve problems by looking at bunches of data in a quickly-understood way which could easily be shared among different user groups, including: managers, organizational people, internet users, etc.

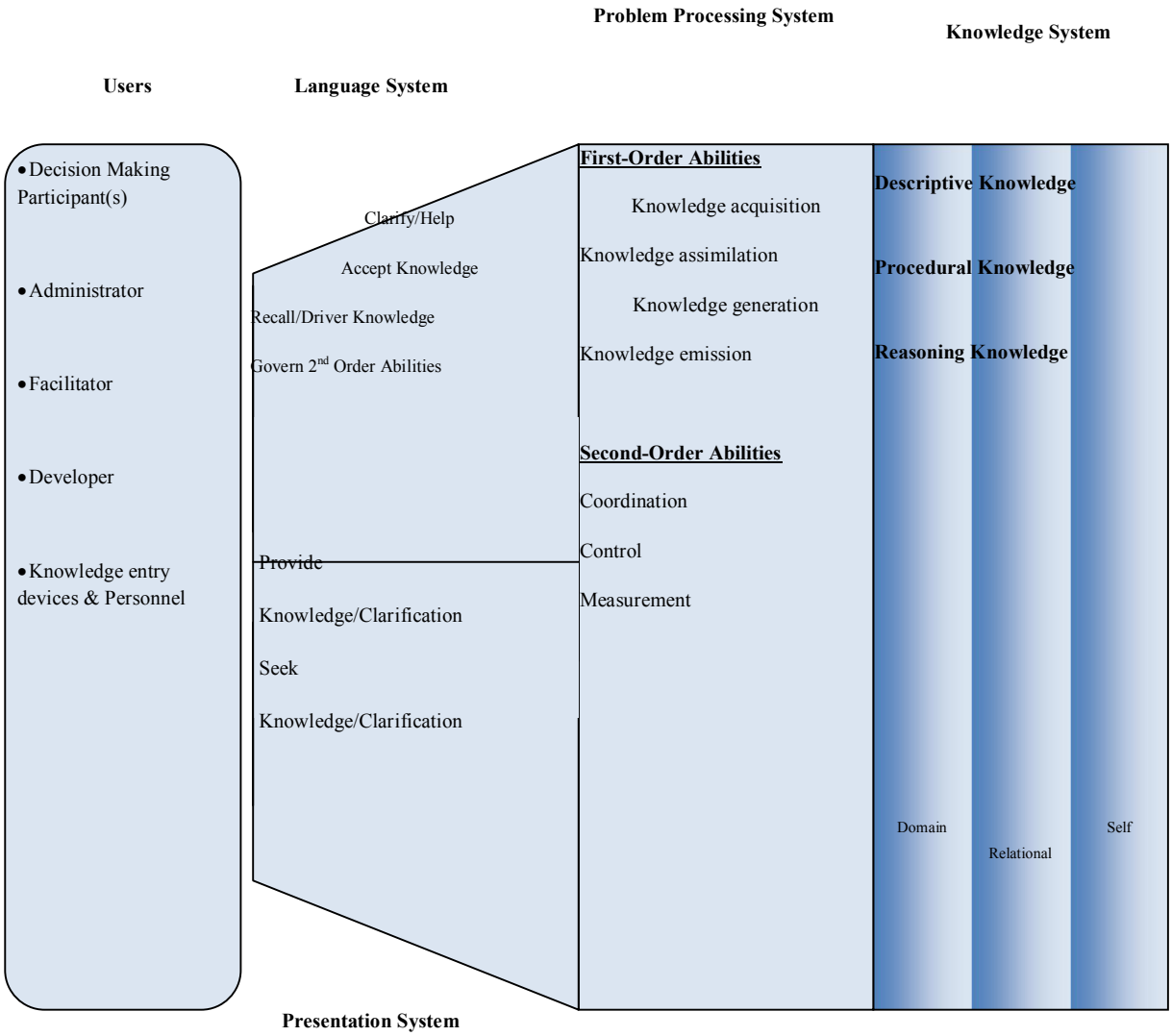


Figure 2- architecture of decision support system. (Burstein ET al.2008)

A GIS can be viewed in three ways (Longley, 2005):

- The database view; which empasizes the importance of a well-designed and implemented database. A sophisticated database management system is seen as an integral part of a GIS. This view predominates among members of the GIS community who have a computer science background.

- The map view; which focuses on cartographic aspects of GIS. Supporters of this view, see GIS as map processing or display systems. In map processing, each data set is represented as a map which is usualy held in raster format.
- The model view; which looks likely to become the most widely accepted by the GIS community and already it can be used to differentiate between GIS and other information systems. This view emhasizes the importance of spatial analysis.

Another important application area for GIS is in GPS and navigators installed in cars. DSS as a system needs a database, retaining its usable data serving the other processing parts, and in this case, GPS can take part and support DSS in terms of data provision. But how GPS is capable to gather and provide the needed data?

The answer is in another occasionally applicable term known as 'image processing', used widely in traffic control systems. Image processing is computerized routines for information extraction (e.g. pattern recognition, classification) from remotely sensed images to obtain categories of information about specific features. As an example, in traffic control of highway, if the number of cars monthly passing a particular street is required, image processing would help.

As discussed previously, this type of information is usually essential in DSS to make highly-qualified decisions.

## 3. An Overview of Tehran Vision In 2025

Tehran in 2025:

"A world city" which is knowledge based, cultural and super eminent in the Islamic world

In January 2007, the city council of Tehran approved the Tehran's vision in 2025. This vision was based on Iran's 2025 vision which was approved by Iranian leader, ayatollah Khamenei in 2003.

The main part of the vision of long-term development of Tehran that is the desired conditions of this city in 2025 is (Industry and Technology Think Tank, 2007):

1. Tehran; a city with Iranian-Islamic identity and organized for betterment and excellence of humanity
2. Tehran; a knowledge based, intelligent and world-class city
3. Tehran; a green, beautiful and lively city, with diverse and widespread public spaces
4. Tehran; a safe and resistant against contingents city
5. Tehran; a sustainable city with a good structure for habitation, work and recreation
6. Tehran; an easy to life city with public welfare and appropriate infrastructures, with regulated injustices and justly recognized citizenship rights
7. Tehran; a metropolis with national and universal role, with modern economy which act as the center of cultural, research and political activities in Iran and at least, as one of the three top cities of West-Asian region.

Tehran city council also published another document named "Tehran in 2025; a world city which is knowledge based, cultural and super eminent in the Islamic world" which was the result of more than 2000 hours of work (Industry and Technology Think Tank, 2007)

In this document, the goals of Tehran are described in 8 categories, as the following:

- Urban economy
- Urban infrastructures
- Urban management
- Urban safety and security
- Urban transportation
- Urban environment
- Urban architecture
- Urban culture and social affairs

## 4. Applications of DSS in urban management

DSS can come in handy in various fields and areas of decision making in urban areas. Torkamani et al (2012) studied the current literature in this area and classified the studies based on the area of urban issues they are concentrated in 7 main categorizes. The categories are as the following

- Transportation
- Sustainability
- Air Quality
- Water Management
- Waste Management
- Urban Infrastructure Management
- Emergency Management

This classification declares the diversity as well as significance of urban issues which could be handled and facilitated by means of DSS.

## 5. Achieving the Visionary Goals via DSS

To identify in which areas DSS could come in handy for facilitating the achievement of Tehran vision, in the first step we studied the documents published by Tehran council carefully and thoroughly. Having studied the Tehran vision dimensions, in the next step we mapped the dimensions with the areas in urban management which were focused to apply DSS in researches and studies. By this approach we identified the major

areas of Tehran Vision in which DSS could be developed and used to improve the efficiency of decision making process.

In this section, we discuss the results by introducing some applications of DSS in each area. We should emphasize that our focus is on areas which DSS can directly come in handy and yet there are other goals which could be influenced by indirect help of DSS.

1. *Development of professional construction activities in the city, especially in commercial and shopping centers, international conference halls, cultural centers and hotels*

Mathematical modeling represents a way of understanding pedestrian behavior in shopping environments and supporting urban planning by predicting pedestrian behavior under alternative plans. These mathematical models can be used in decision support systems to make better decisions in urban planning with focus on pedestrians (Zhu & Timmermans, 2006).

*Improving infrastructures of water saving, treatment and distribution.*

Water mains rehabilitation is a major challenge for water supply companies, with a large annual and protracted budget. The decisions made in current and previous years affect the decisions to be made about future water supply infrastructure maintenance. Designing a framework that models and augments different parts of the current human strategy used in making rehabilitation decisions (expertise of the water company engineers, their consultants and theirs information handling models, can help water supply companies to make better decisions (Davis, 2000)

2. *Trying to increase the sense of security and safety in people; especially by severe confronting to minor crimes.*

A number of urban areas, including Tehran, have experienced severe floods in the past. In order to get sufficient time to alarm inhabitants and plan reactive measures, it has been found important to use advanced forecasting and monitoring techniques and a decision support system to assist authorities in their decision making. The studies show that the problem of flood warning based on forecasts is one of great complexity and uncertainty. It is believed that results can be improved with better forecasting techniques, improving catchment models, with experience using the DSS, and increasing experience of the public about the meaning of flood warnings (Abebe & Price, 2005)

Another use of DSS in achieving this goal would be in managing contingencies in the city. Many contingencies, both natural and man-made, have taught people that well coordination of organizations involved in emergency is very critical for effective response, and decisions ought to be made on the foundation of a synthetically analysis of data from multiple sources. These lessons bring new requirements for emergency Decision Support System (DSS), which include the capability of integrating data from incident-related organizations in real time and performing a comprehensive analysis and model computations. For a better response to variety of urban contingencies (fires, flood, accidents, crimes, etc.) a DSS can help urban managers. (Zhang & Li, 2008)

3. *Reinforcing Tehran's police by using modern police technologies to prepare it for confronting new crimes like electronic crimes and organized crimes*

DSS can be used by police force to manage patrols to visit historically critical hot spots (Keskin et al.2012) Also DSS can be used to real-time routing of police cars to get faster to the place of crime (Zografos & Androutsopoulos, 2008). It can be conclude that the DSS can help urban managers to have a police with faster and better services to people.

4. *Developing public transportation system to be a reliable, reachable, safe, fast and cheap transportation system*

Within the general framework of a multi-modal transport system, both private and public transport modes are managed by a planning authority that has control of traffic decision variables. In this scheme, urban transport management seeks for policies that would enhance the efficiency of transportation supply with particular concern. DSS can assist transport administrators to enhance the efficiency of transportation supply while improving environmental and energy indicators. Models can be generated to allow the estimation of traffic flow patterns within each link of the road network starting from knowledge of network characteristics and traffic demand. These models evaluate several policies selected by using collected data from several sources. The implementation of a traffic management strategy would involve a set of mathematical models to perform transport network analysis and estimate the corresponding impact on environmental and energy indicators, an interactive procedure for providing alternative scenarios for the transportation infrastructure as well as rational automated procedures for comparing the results (Arampatzis et al., 2004)

Decision support systems can also be used for managing public transportation systems. They can be used in rescheduling problems, and help public transportation systems to be more reliable. Disruptions in trips can prevent vehicles from

executing their schedules as planned. Mechanical failures, accidents, and traffic congestion often hinder a vehicle schedule. When a vehicle on a scheduled trip breaks down, one or more vehicles need to be rescheduled to serve the passengers on that trip. DSS can reschedule the vehicles in real-time to make transportation system more reliable (Li et al. 2007).

5. *Wide use of intelligent transportation systems and using modern and intelligent traffic control equipments*

Traffic management is generally subdivided into two different classes: (i) direct control measures using traffic lights and variable message signs and (ii) indirect control measures like recommendations for the drivers by means of variable direction signs and text panels (VDS), warning messages (via broadcast, RDS/TMC or handy-based services), pre-trip information (e.g. via Internet) and individual driver information systems. The global architecture of traffic control systems bases on the detection of traffic data and environmental data several detection sites are assigned to an outstation that controls isolated control instances. Several outstations are connected to a sub-center that is connected to a traffic control computer center (TCC). The TCC coordinates all control measures as well as interacts with the police to manage congestion situations. For an enhanced congestion management the TCC generates the information, predictions and recommendation that allows the roads could be used more intelligently. The detected traffic data enable the automatic detection of traffic incidents. Intelligent analysis and prediction algorithms monitor the current traffic situation in the relevant granularities. This situation analysis and prediction allows the automatic derivation of network control measures. Based on ascertained traffic situations incident messages are generated and optimized by grouping equal conditions of related sections as a summarized message (Kirschfink et al., 2000)

DSS can also be used in vehicle routing problems. Vehicle routing problems are complex situations where information systems can help the managers to make better decisions. Decision support systems can help urban managers solve these kinds of problems in the cases like planning of audit operations. (Mendoza et al., 2009)

6. *Performing studies about the technologies and methods used in garbage treatment*

Many studies of facility location theory are concerned with locating facilities such that some distance objective, expressing nearness to residents is optimized. Distance minimization is however not a good performance indicator for all facilities, because some facilities such as waste disposal give residents feelings of dissatisfaction. Location problems for these kinds of facilities require new methodologies with corresponding solutions. (Zhou et al. 2006)

Vehicle routing is a common and costly problem faced by many private and public sector enterprises. Two of the most basic vehicle routing problems are the traveling salesman problem (TSP) and the Chinese postman problem (CPP). Trash collection enterprises are facing this problem. A DSS can help these enterprises to optimize the roots of vehicles to minimize the time and cost of collecting trashes. (Santos et al., 2008)

7. *Revival of architectural identity of districts and uniformity in townscape by formulation and implementation appropriate policies in managing townscape*

Urban design is a complicated decision making process that involves multiple entities of various interest and constraints. The heterogeneity of urban resources and diversity of involvement raises serious demands for sophisticated communication between government, civic institution, engineers, real estate developers, communities, etc. The communication process, especially with the local community has become more important with the growth of civic rights and public activism. Moreover, each city has very unique situations and problems. The explicit and insightful examination of the locality is resolved into contemporary major urbanism issues: regional planning, comprehensive planning, and strategic and sustainable development. Therefore, a systematic way is the most essential task in the design process. The analysis and identification of existing (and prospective) urban context in a systematic way is the most essential task in the design process. (Oh et al., 2006)Another use of DSS is in comparing different designs in terms of attractiveness and effectiveness. As an important element of urban form, streets function as social spaces, commercial spaces, cultural spaces, as channels of movement and as symbolic representations of local tradition and culture. Since street spaces are not only compromised of physical elements but also of people who are moving and using them, informal street activities emerge as an integral part of street life. Urban designers faced with the task of designing such spaces, needs a tool that will allow different designs to be compared in terms of their attractiveness and effectiveness (Chen & Chiu, 2006).

## 6. Recommendations

It is recommended that urban managers organize teams to study these applications and other applications of DSS which could help Tehran be a better city. Some of applications that can be discussed in these teams are:

It is recommend for Tehran to be researched and analyzed by technical specialists to see in what exact areas DSS can help urban managers to achieve a more sustainable city. Nevertheless, some general recommendations are proposed shown in

Table *2*. These examples of DSS applications in urban management are linked to the 8 categories of goals in Tehran vision 2025 to express the impact of DSS in achieving these goals.

Table 2- Recommendations for Tehran urban management

| DSS capability | Facilitates achievement of goals in category of | Some examples of DSS applications |
|---|---|---|
| Transportation | Urban transportation | • The use of DSS in real-time traffic management<br>• The use of DSS in public transportation management systems; including the real-time management of BRT 1 lines, Metro trains, etc. |
| Sustainability | urban environment | • Assessing the environmental performance of urban systems and define suitable scenarios to control the developing trends toward sustainability. |
| Air Quality | Urban environment | • Predicting potential atmospheric pollution problems in a timely, efficiently way. |
| water management | Urban environment | • The use of DSS in flood management |
| waste management | Urban management, urban environment | • The use of DSS in vehicle routing problems for optimizing the routes of garbage collection vehicles. |
| Urban Infrastructure Management | Urban infrastructure management, urban architecture | • The use of DSS in designing public spaces by modeling pedestrian behavior<br>• The use of DSS in maintenance of water supply systems |
| Emergency Management | Urban culture and social affairs, urban safety and security | • The use of DSS in identifying historically hot spots by police to make Tehran a safer city in 2025.<br>• The use of DSS in contingents and disaster management. |

[1] Bus Rapid Transit (BRT)

## 7. Conclusion

Achieving Tehran's vision needs cooperation and hard work of all urban managers, with a strong support from the government. Without this support, the abundant problems of this city (traffic, air pollution, weak public transportation system, old and inefficient water supply system, etc.) wouldn't be solved.

Of course DSS can't solve all the problems of Tehran lonely, but as it was mentioned above, it can help urban managers to effectively plan to move towards Tehran's 2025 vision. The main focus of this paper is to explain in which areas of Tehran vision and how DSS could facilitate achieving goals. We recommend that DSS would be applied in water treatment systems, emergency and disaster management, traffic control and management, energy saving, public transportation management and designing public spaces. In addition, along with use of DSS, it is recommended that the authorities of Tehran use other information systems such as EIS and MIS in order to have a more clear understanding of situations and make better decisions on their way to Tehran 2025.

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