



# Prediction of Digital Governance in the Direction of Urban Smartness with Sustainability Approach (Case Study: Tehran)

Bahram Parvin<sup>a</sup>, Ali Shayan<sup>b,\*</sup>, Ali Poorebrahimi<sup>c</sup>, Reza Radfar<sup>d</sup>

<sup>a</sup>Department of Information Technology Management, Science and Research Branch, Islamic Azad University, Tehran, Iran

<sup>b</sup>Department of Information Technology Management, Tarbiat Modares University, Tehran, Iran

<sup>c</sup>Department of Industrial Management, Karaj Branch, Islamic Azad University, Alborz, Iran

<sup>d</sup>Department of Industrial Management, Science and Research Branch, Islamic Azad University, Tehran, Iran

Received 05 June 2023; Accepted 20 September 2023

## Abstract

**Objectives:** In this research, the researchers seek to present a mechanism for digital governance foresight in the direction of urban smartness with a sustainability approach based on scenario writing in the city of Tehran.

**Tools and methods:** The research method is mixed in terms of how to check the data; Because it uses both quantitative research strategies (in expert data) and qualitative method strategy (in interview content analysis). In terms of the nature of the data, the current research uses both quantitative and qualitative methods. This article is included in basic-applied research. Because the research is exploratory and its main purpose is to identify the environmental drivers related to the subject of the research, therefore the research is of a fundamental type; At the same time, its achievements are included as a benchmark for urban management, especially relevant organizations including the municipality, so it is also considered practical. The statistical population of the research includes elites, managers, and senior experts, whose opinions can be used in the field of digital governance and urban smartness with a sustainable approach.

**Finding :**Based on the results, the first scenarios in the areas of intelligence, participation, transparency, structural arrangements, integration, culture and stabilization of the best scenario and the sixth scenario, and to some extent scenario 5, the worst possible scenarios are the worst. The second to fourth scenarios are based on the least changes in the main factors and showed improvement in one factor and in one factor the regression was shown.

**Resulting :** The results showed that capacity-building to create the right to access information, increase law-abiding, discipline urban management mechanisms, and strengthen internal platforms for networking and securing information in line with urban intelligence can be implemented through the implementation of digital governance requirements.

**Keywords:** Digital governance, urban smartness, sustainability, environmental drivers, scenario

## 1.Introduction

The system of urbanization and its rapid process in developing countries causes a massive influx into cities and the emergence of a swollen service sector, widespread marginalization, hidden unemployment, and the emergence of dual social networks of immigrants in cities. In other words, urbanization is one of the most important phenomena of the present age, to the extent that there is talk of an urban revolution in the world. In such a situation, urbanization will be associated with many consequences, such as the distribution of injustice, the

spread of social damage, and increasing social heterogeneity, and help to spread all kinds of social, economic, and cultural crises until the sixties, the post view Modern was presented as an important style and basic criticisms were introduced to modern rationalist thought. As the main factor in the city, the whole city was formed around him, his wants and needs, for a long time, he was forgotten in urban discussions, and in contrast to the car, which was once used to facilitate and improve the quality of life, especially Urban life was invented and has become the dominant element of cities (Dadfar and Bandarabad, 1400). Unfortunately, the result of the transformation in

\* Corresponding Author. Email: ashayan@modares.ac.ir

cities, including Tehran, caused the weakness of urban planning and, as a result, the dissatisfaction of the citizens. Unbalanced and disproportionate distribution of functions in the city, lack of attention to the shape and spatial features of the environment, creation of ambiguous and unpredictable spaces, lack of continuity of physical elements, imperceptible edges, and lack of lively and lively spaces, are all factors that Nowadays, confusion and chaos have been created for the citizens in various dimensions. In general, when people come together and form a society, as a result of mutual actions and interactions, they manifest their different social and cultural aspects, which is the meaning of human society. Social space is a space based on interaction and it requires communication. The city is also a physical cultural complex that should be formed based on the needs, activities, and behaviors of its residents, not the profit-seeking requirements of the market, which has taken possession of urban spaces with the dominance of neoliberal attitudes since the 1980s. Humans act according to their individual or group needs and present their own behavior patterns, so the city and its different spaces are a platform or container for such events. In fact, man is a self-aware, free being and all these characteristics are the product of the ancient evolutionary heritage of his creation and social habitat. By seeing himself and his attributes in something, he feels it is close to him and a part of his existence. Now, the more the space addresses the human being and the easier it is to interact with him, the more it is in harmony with the habits of his behavioral patterns, and the more it responds to his memories, expectations, and wishes, this space will create more sense of belonging in humans (Rafiiian et al., 2012). There are about 2 billion people on earth who live in cities, that is, about half of the human population lives in an urban environment. This number is increasing, which creates big problems for more people, increased traffic, increased noise, increased energy consumption, increased water consumption, and land and waste pollution. Therefore, the issue of security, along with sustainability, is expected to be addressed in cities that use their brains. One of the common methodologies for creating a smart city is the Internet of Things (IoT). IoT connectivity is the heart of the city that makes a smart city. Such as sensor networks, wearable devices, mobile applications, and smart networks that have been developed to use the most innovative city connection technology to provide services and better control of citizens (Rondik and Hassan, 2021).

More than 50% of the world's population lives in cities today. Supporting such an urban population requires huge efforts from the point of view of urban management. In addition to these problems, the impact of urbanization on the global climate has also been in the spotlight. Therefore, solutions are needed to solve these challenges. Smart city technologies, in a broad sense, will be an integral part of such solutions. This has led major global ICT players to launch their respective smart city initiatives. For good reason, the smart city market is estimated to be in the hundreds of billions of dollars by 2020, with annual spending approaching \$16 billion. In the conditions of change and unprecedented challenges, intelligent governance should increase the ability of its funds and resources not only to function in normal conditions but also to adapt to unforeseen conditions, and respond to shocks, changes, and threats. Considering all aspects of smart governance helps local authorities to be best prepared with a long-term orientation and appropriate action plans for urban development (Nagyin, 2020). In this perspective, the urgency and need for a transformative perspective on urban governance facilitated by information and communication technology, which includes smart urban governance as a method based on context and a socio-technical method for managing cities, is felt:

- 1) The problems of technocratic and corporate "smart" governance require a smart urban governance.
- 2) The theoretical focal points of smart urban governance show its transformational potential in managing urban challenges.

Based on these arguments, it is recommended that researchers and practitioners use smart urban governance to manage the most pressing urban challenges with the accessible urban theme, promote demand-based governance practices, and shape technological intelligence more socially (Solistio et al., 2019).

According to the mentioned materials, in the present article, the researcher is looking for an answer to this basic question, what is the future vision of digital governance in the direction of urban smartness with a sustainable approach? Theoretically, the importance of this current research is that it looks at the issue of digital governance from a new and creative perspective and for the first time explores it in a context provided by the approach of urban intelligence. The concepts and principles that are used in the link between digital governance and urban smartness have not necessarily been used by other

previous researchers and the researcher's investigations have shown that other previous researches seek to answer the questions raised. In this research, they did not come up. In addition, the field data of the research is related to the beginning of the new century and it is also important in this respect. From the practical point of view, the importance of the current research is that the urban management institution, including the municipality and the city council, can primarily use the results and achievements of this research to improve the state of urban management, and if the current research is based on the solution and model It is desirable to achieve in the city of Tehran, which can be extended to other cities of the country as well.

## **2.Theoretical Foundations and Background Research**

### **2.1.Digital Governance**

Every organization is managed by a governing body (a person or a group of people who are responsible for the most important actions). One of the activities that every organization with every mission and vision does continuously is governance. A team of top managers with a senior manager can rule the organization. The ruler is responsible for matching the rules of the organization with the laws. In other words, organizational governance refers to the mechanisms for managing and controlling the organization. The main activities of the ruler are assessment, guidance, and supervision (Hasan and Akhtar, 2019). In general, governance means structures that determine how to perform responsibilities and duties, and determining governance mechanisms, it can lead to greater effectiveness of actions and transparency in organizational responsibilities. In the meantime, managing and monitoring the digital transformation of an organization requires new methods of management, new capabilities, and competencies for leadership, if an organization can successfully establish digital governance at the organizational level. which can create forward-looking, comprehensive, and innovative planning for survival in the digital age organizations (Delon et al., 2018). A digital ruler, according to the duties and competencies he needs to be effective in this responsibility, determines, directs, and monitors digital-oriented measures in the organization and aligns the direction of activities with the organization's overall goals. The presence of digital governance will prevent the wastage of resources and will increase the effect of digital transformation measures (Mejer, 2015). Digital

governance means an organizational structure for the development and allocation of organizational resources in the field of digital transformation. The purpose of this mechanism is to advance the organization's digital actions as best as possible. Digital governance is also derived from the macro concept of governance. Every organization is managed by a governing body (a person or a group of people who are responsible for its most important actions). One of the activities that every organization with every mission and vision does continuously is governance. Digital governance plays an important role in controlling the process of this fundamental change in the organization by determining the duties of individuals in line with advancing the goals of digital transformation (Indiasazi et al., 2020).

### **2.2.Urban Smartization**

One of the new concepts to reduce the problems of cities in the field of urban planning is the development of a smart city, which has received a lot of attention in the last few years (Syed Asad and Bukhari, 2022). The smart city has been proposed as the axis of transformation and development of the millennium and means the opening of new concepts in urban planning (Hardianti et al., 2019), which combines the capabilities of the real and virtual worlds to solve urban problems. A lot of data generated in the city space, together with the developments in the field of information and communication technology, creates unique opportunities to deal with the big challenges of cities (Sumro and Bohata, 2019). One of the most important foundations of a smart city is access to real-time information on the actions and choices of citizens (Khodadadi and Abbaspour, 1991). The advantages of smart growth include increasing density, integrating activities within the city, internal development, combining uses, reducing land consumption and reducing distances between work and living, more useful use of space, and reducing energy consumption, He pointed out that reducing environmental pollution, reducing the use of private transportation and increasing the use of public transportation, maximum access to urban services, etc. can increase the quality of the urban environment. Because smart urban growth emphasizes issues such as mixed uses, the use of compact buildings, and the creation of pedestrian neighborhoods (Rondik et al., 2021). A smart city takes into consideration the increase in the quality of life with the development of electronic devices in the city at the same time and

raises the issues of sustainable development along with participatory governance in urban management (Hataminejad and Mansouri Zasad, 1400).

### **2.3.Stabilization**

Almost from the beginning of the 1970s, the assumptions of the development paradigm were seriously questioned. Many problems have plagued humanity, including increasing poverty, inequality, human sacrifice, environmental disasters such as pollution at the local and global level, increasing scarcity of freshwater resources, erosion of soil resources, destruction of forests, The destruction of biological diversity, and the immorality governing the previous patterns of development were initially noticed by experts and experts; Therefore, as a result of these problems, the old paradigm of development faced fundamental challenges and led to the introduction of a new paradigm of development by experts, namely sustainable development (Rehbar et al., 2018). In general, three categories of factors have contributed to the spread of sustainable development thinking (Zahedi and Najafi, 2016):

- 1- The dysfunctional results of the implementation of structural adjustment policies that were formulated to deal with the global economic crisis in the 1980s;
  - 2- The relentless and unstoppable increase of poverty, hunger, and inequality in the world;
  - 3- Worrying destruction of the environment and natural resources as a result of the use of technologies
- The first efforts were caused by the concerns of several thinkers who believed that humans are destroying their environment, the environment in which they have historically lived and are biologically dependent (Ana Viswezi et al., 2018). This is the first evolution and revolution in attitude that occurred in the late 1960s and was characterized by the debate about the quality of the environment against economic growth. Accordingly, a delegation of development and environment experts met in Switzerland in June 1971 and focused on the issue of protecting and improving the environment as an urgent need of developing countries. The recommendations of this committee, which was known as the recommendation of the Phoenix Summit, were discussed in a series of regional seminars held under the same name. However, it should be said that two conferences and a commission played an essential role in explaining and paying attention to sustainable development, which are (Salamrouzi and Sheikhi, 1400).

### **2.4.Foresight**

Foresight can be considered as a tool for predicting technology, or it can be considered only as a method of evaluating or predicting technology, or from another point of view, it can be considered as a part of the strategic management process, especially in the analysis of the external environment. But it seems that foresight is more than anything else a tool for policy making (Siah and Asadi, 2013). Forecasting can be used for various purposes depending on the situation of each country or region. Defining diverse and broad goals can be desirable for all organizers of activities of this kind. But there are always limitations that force the organizers to choose a number of goals. These limitations are things like the budget and time required for implementation, the level of development, human resources, etc. In this way, every foresight program tries to combine "desirable goals" and "existing limitations" to obtain appropriate goals and methods that can create the best intermediate point. Some also consider the general goals of foresight to be imagining possible events, evaluating probabilities and finding possible events, and making decisions in the direction of preferred affairs (Abaft and Rezazadeh, 2018).

### **2.5.Environmental Drivers**

According to Drucker (1999), environmental drivers refer to the major forces shaping the future of the world. It is obvious that drivers indirectly affect different fields. In other words, the main components or factors consist of several trends that cause changes in a studied area (Rahsapar et al., 2018). Environmental drivers refer to a set of factors that can change the business process. These drivers exist in all fields of industry, culture, investment, etc. In other words; Environmental drivers surround businesses and affect them at a point in time and in the future horizon. Environmental drivers, which are also called driving forces in strategic management literature, have been able to attract the attention of many researchers in the field of future research. (Sana'i et al.,2020) stated that environmental drivers are particularly important in the organizational field, especially in the field of reengineering and creating the necessary flexibility against environmental threats. (Rezayan and Marzban,2018) believe that global trends on the one hand, and environmental trends and drivers on the other hand affect the future of Iran in various fields, which pay attention to the strategic foundations and foresight in the environment.

complex and unpredictable, by using scenario thinking (based on the identification and re-examination of the drivers and uncertainties of the future) concrete and understandable images of imaginable or possible futures can be presented in the form of multiple scenarios. To provide a clear definition of environmental drivers, (Neiri et al., 2017) state that the interaction of influencing factors and components in any phenomenon is called environmental drivers. Drivers are a set of future-shaping forces that globally or locally affect different futures and shape the future (Al-Barzi Dawati and Nasralhi, 2017). Future research and knowledge of the future is a vital necessities for policymakers and executives in today's era of extensive and rapid changes, and decision-making without considering possible future trends is not feasible or reasonable. To examine the future, the factors and components affecting the future of each subject or phenomenon must be evaluated, and with, the correct understanding of each of these components, planning and making strategic decisions appropriate to the future of the issues and subjects to Turning the conditions facing the future into suitable opportunities. Drivers are among the major forces shaping the future of issues and phenomena. In futurology texts, drivers refer to the major forces shaping the future. Drivers indirectly affect different fields. In other words, the main components or factors consisting of several days cause changes in a studied area. In another definition, a driver is a term that is used to refer to any "changing force" that catches future transformation, influences it, and shapes it. This change can be caused by individuals, institutions, or even circumstances (Akhan Kazemi and Nikonhad, 2017).

### 3.Research Background

The summary of internal and external research related to the research topic is as Table (1):

Table 1:  
Summary of Internal and external research

Row	Research Topic	Researcher and Year	Research Method	Research Results
1	Pathology of Digital Governance in E-Government	Bikzad and Jalilnejad (1400)	Qualitative Analysis Method	Digital governance indicators should be done in the form of organizational assessments and structural barriers should be eliminated in organizations.
2	Investigating the effects of the smart city on the livability of cities (9th district of Mashhad metropolis)	Hataminejad and Mansouri Etminan (1400)	Multi-Criteria Decision-Making Method	District 1 of Mashhad Municipality District 9 is smarter than other areas in terms of smart city standards.
3	Explanation of Smart City Principles and Strategies with Sustainability Approach in the Field of Crisis Management	Mulai (1400)	Qualitative Study	The sustainable smart city approach with smart city management and intelligent processes, provides benefits such as accelerating management of issues and services, integration of decisions and actions of officials and people, transparency and monitoring and controlling violations, reducing unnecessary travel, and saving energy.
4	Presenting a Techno-Economic Model of Sustainable Communication Infrastructure in Smart City Using Fiber Optic Access Network	Asgari Rad et al (1400)	Content Analysis	Providing basic connectivity in the smart city with the proposed model, in addition to meeting technical requirements, will reduce the cost of network creation, reduce the vulnerability to a variety of threats and increase the reliability and security percentage.

5	Conceptual Framework for Digital Judicial Transformation in the Direction of Digital Governance	Kondari and Rouhani(2020 )	Method of Omkhite	Effective dimensions and components include enablers (including two layers of infrastructure components and technological components), applications (including challenges, incentives, and opportunities), judicial ecosystem (including two layers of internal stakeholders and external stakeholders), digital transformation governance, digital transformation roadmap (including three layers of vision, goals, and plans) and digital transformation journey (including five stages).	9	Investigating the Driving Drivers for the Implementation of Smart City	Tokody and Shuster (2021)	Hypothesis Test	International and European standardization efforts demonstrate the importance of a holistic approach to cities and urban issues as complex systems, as well as the relationship between cyber-physical systems and smart cities in the field of urban sensitization. We propose three clear categories for categorizing security interventions in smart cities: those that use new sensors but traditional stimuli, those that seek to make older systems smarter, and those that introduce entirely new functions.
6	Measurement and Evaluation of Smart City Indicators in Ahvaz Metropolis	Guidance and Partners(2020 )	T-test method	Zones 3 and 2 have the most favorable conditions and Zones 1 and 5 have the most unfavorable conditions in terms of smart city indicators.	10	Security and Smart City: A Systematic Review	Laouf et al. (2020)	Conceptual Development	Cities that are more than average EU participants in smart city policies are also more inclined to patent. This effect is stronger for high-tech patents, while for technically more precise definition classes is reduced.
7	Designing a Governance Reform Model with Digital Governance Approach	Abolmaali and Pourezat(2020 )	It's mixed up.	Effective dimensions for implementing digital governance - require reengineering of cultural- technological- and economic systems as the most important factors for reforming the administrative system. Finally, the results include a seven-part model, which is derived from the combination of literature on business models in the field of smart cities.	11	Smart Innovative Cities: The Impact of Smart City Policies on Urban Innovation	Caragillo and Dilbo (2019)	Structural equations	
8	Integration of business models in the smart city	Farjood et al (2020)	It's mixed up.						

#### 4. Research Gap and Innovation

With the investigations carried out from past research in the domestic and foreign fields, most of the studies in the field of digital governance indicators from the perspective of implementation mechanisms, influence on variables such as organizational transformation, performance, profitability, management Finance, acceleration of processes, etc., were desired in various businesses and industries, and also the aforementioned research lacks insight into the dynamic capabilities and routines required for the development of governance from an ecosystemic and systemic perspective and in the field of intelligence. It was a city. Especially, in Researchers such as (Moulaei,1400), (Asgari Rad et al.,1400), and (Kennedy and Rouhani,1399) expressed the basics and strategies of the smart city in line with effective

management and improvement of urban smarting processes and expressed theories in line with The implementation of the smart city has been discussed with a view to the stabilization of the processes and the progress of the urban convergence, according to this outstanding research, this article examines how the digital governance model in the direction of urban smartness with a sustainable economy approach can be used through dynamic capabilities. To coordinate ecosystem innovation within urban mechanisms, and thus lead to desirable outcomes, it is attempted through a case study of smart city initiatives to gain insights into the underlying principles or sub-routines for capabilities. Sensing, recording, and reconfiguration from the perspective of digital transformation in the urban area, these principles and procedures coordinate urban processes, through alignment, alignment, and direction to urban activities through mechanisms Governance is on the agenda. On the one hand, it is based on internal and external research, since cities have taken on complex forms that include a limited area, an urban environment (a set of factors that affect the objects and topics presented in the area), and citizens. They grow rapidly in time and space, and the modern city can be compared to a laboratory in which a person simultaneously creates and is a product of the surrounding environment. Historically, cities have never been considered a "place for the growth of human talents and talents." Ancient cities were created to protect citizens from foreign enemies. In the pre-industrial era, cities were centers of trade and handicrafts and later became centers of industrialization. And only in the post-industrial era, the city has become the center of intellectual development and innovation in all parts of the urban environment, marking a transitional stage for creating an intelligent society. For this purpose, the innovation of the present article in completing the research gap includes the identification of environmental drivers effective in digital governance based on urban smartness with a sustainable approach through a mixed strategy (qualitative-quantitative).

## **5-Materials and Methods**

In the current article, the research method is mixed in terms of research method. Because it uses both quantitative research strategies (in expert data) and qualitative method strategy (in content analysis of existing technical and specialized resources). In terms of the nature of the data, the current research uses both quantitative and qualitative methods. The

meaning of qualitative data is a place where, while studying documents about the characteristics and dimensions of humanistic cities and citizens' participation, it examines past research and examines internal and external sources. However, when it tries to score each of the statements of the questionnaire (components, indicators, etc.) with a fieldwork questionnaire), it is based on a quantitative method. So, in general, the current research is considered to be a mixed type of quantitative and qualitative. Therefore, in general, in terms of the nature of the data, it is quantitative-qualitative. Of course, it is necessary to mention that the format approach in this research is quantitative. The present research is included in basic-applied research. Because the research is exploratory and the primary goal of the exploratory method is knowledge, the research is of a fundamental type. At the same time, its achievements will be the benchmark for urban management, especially the municipality, so it is also considered practical. In the macro view, this research uses a prospective approach. Future research consists of a set of efforts that visualize potential futures and plan for them by using the analysis of sources, patterns, and factors of change or stability. Foresight reflects how from the changes (or not changing) of "today", the reality of "tomorrow" is born. This term is equivalent to the Latin word "Futures Study". The plural word Futures is used because, by using a wide range of methodologies and instead of imagining "just one future", systematic and intelligent speculations are made about not only "one future" but "several imagined futures". Foresight topics include "possible", "probable" and "desirable" types for transformation from the present to the future. Foresight is to monitor global changes, especially in the field of information technology, as well as specifying possible, probable, preferred, and desirable futures. Foresight is an interdisciplinary discipline and is used in all fields, it is knowledge that keeps people's eyes open to future events, opportunities, and possible risks. It reduces the ambiguities and doubts and erosive concerns of people, increases the ability of society and people to choose intelligently, and allows everyone to know where they can go (analytical or exploratory future approach) Where should they go (normative future) and from what paths can they reach their desired futures more easily (imaging approach or future-oriented strategies).

### 5.1.Society and the Statistical Sample of the Research

Many formulas and solutions have been proposed by statistical experts to determine the size of the statistical sample. The sample size should be determined in such a way that the researcher does not incur excessive costs in addition to access to correct statistical inferences. Interpretive structural modeling is a structured method to establish relationships and understand the relationship between the elements of a complex system, which was introduced by Warfield in 1974 (Atesh Souz et al., 2015). This modeling is an interactive process in which a set of different and related elements are structured in a comprehensive systematic model (Azer and Bayat, 2017). This type of modeling seeks to direct the relationships between components in a system. In the method of interpretative structural modeling, it is necessary to obtain the opinions of experts and analyze them. Among the selection criteria of experts, we can mention the scientific mastery of urban management concepts, practical experience in the field of macro-urban management, as well as the willingness to participate in the research process. The next important point is that considering the scope of the topics in the metropolitan area, it was tried to select people with different educations for these interviews. In various articles, the number of different experts participating in the interpretive structural modeling process was 20 people, who are academic experts and general managers in the field of digital transformation, urban smartness, and sustainable approach, whose characteristics are listed below. were selected to participate in the research process.

Table (2):

Research experts		
Gender	Man	14
	Wife	6
Education	Master's Degree	3
	Ph.d.	17
Work Experience	Between 5 and 10 years	1
	Between 10 and 15 years	3
	Between 15 and 20 years	6
	Between 20 and 25 years	5
	Between 25 and 30 years	5
Field of study	Digital Transformation	10
	Urban Smartization	6
	Sustainability	4

### 6.Findings

MAXQDA software version 2018 was used to analyze the conducted interviews. For this purpose, 13 conducted interviews were entered into the software as documents, and the line-by-line analysis of these texts resulted in the identification of 202 open codes. It should be noted that determining the axis of the codes was problem-oriented. By categorizing and determining the main axes of these codes, the following results were obtained.

Table (3):

Frequency of open codes based on main axes	
Main Axis	Abundance
Clarification	39
Pivotal participation	47
Accountability	38
Stabilization	23
Integration	44
Structural Arrangements	34
Cultivation	17
Intelligence	10
Total	252

In the following, the frequency of the main topics in each axis is given.

Table (4):

frequency of main topics in the axis of clarification		
Dimensions	Environmental drives	Abundance
Accountability	Accountability	10
	Law Oriented	6
	Commitment	8
	Demand	14
	Total	38
Stabilization	Attention to e-Government	3
	Attention to the environmental sphere	5
	Implementing the Green Economy	15
	Total	23
Integration	Software Infrastructure	4
	Aggregate data and information	7
	Information Security	3
	Privacy	12
	Intellectual Property Information	14
	Hardware Equipping	4
	Total	44
Structural Arrangements	Organic Structure	9
	Agility	5
	Specialization	3
	Knowledge-based	6
	Pivotal Team	4
	Organizational Innovation	4
	Effective Management	3
		Total



Dimensions	Environmental drives	Abundance	
Clarification	The right to access information	11	
	Process transparency	15	
	Transparency of workflow	6	
	Process Modeling	4	
	Discipline	3	
	Total	39	
Pivotal participation	Crowdsourcing	12	
	Participatory Decision Making	14	
	Participatory Transparency	7	
	Update Partnership	6	
	Development of group and council services	5	
	Publicization	3	
	Total	47	
	Cultivation	Education (citizenship)	5
		Reducing social problems	3
		Strengthening Cultural Sites	6
Pay attention to social capital and social health		3	
Total		17	
Intelligence	Service Optimization	5	
	Exchange of data and information between citizens and related entities	3	
	Networking	2	
	Total	10	
	Total	34	

According to the above tables, the interview topics and codes were categorized into the 8 main dimensions of clarification, central participation, culturalization, intelligence, accountability, stabilization, integration, and structural arrangements. Many variables extracted from the interview were the same as the variables obtained from the general questionnaire. According to the frequency table, components such as process transparency, collaborative decision-making, implementing green economy, securing information, creating an organic structure, paying attention to social capital, networking, and collaborative decision-making were among the most important and frequent items mentioned by the experts; As mentioned, many of these components were measured and counted in the first step; But 10 variables were added to the total of 57 variables that were not included in the first step.

### 6.1. Analysis of Indirect Effects

To use Mic Mac software, 67 parameters were included in a cross matrix and were rated using the opinion of 20 experts. The final matrix of experts' opinions was created using the mode of these experts' opinions. After entering the variables and the final matrix of experts' opinions on the degree of

connection between these variables as software inputs with the titles of direct effects matrix (MDI) and potential direct effects matrix (MPDI), the output matrices with the titles of indirect effects matrix (MII) and the potential indirect effects matrix (MPII) was obtained.

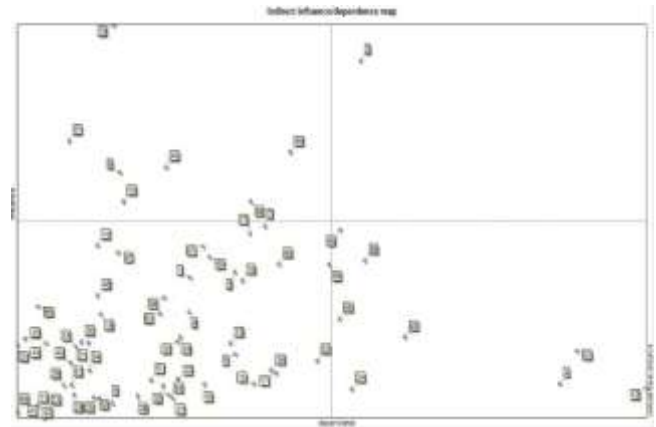


Fig.2. Cross effects map based on indirect effects matrix (MII)

The variables that are near the northwest show the influencing factors, 7 influencing factors on the whole system. These variables are the most important influencing factors in the development of digital governance based on urban intelligence with a sustainable approach, which includes: participatory transparency, popularization, privacy, creating an organic structure, agility, networking, and service optimization. The right side of the figure and the northeast part show the two-dimensional variables. These variables have two common characteristics of high influence and high influence, which are divided into two categories of risk and target variables. Risk variables are formed above the diagonal line of the northeastern region and have a great capacity to become key players in the system. Various public transport options are located in this area. The influencing variables are located in the southeast part of the figure and can be called non-result variables. These variables are the result of independent variables, and if the independent and influential variables have a positive trend, they have a low influence. These variables do not have a key and important role in the future of Tehran, but they should not be completely forgotten. Adjustment variables are placed near the center of the figure. They have a regulatory mode and sometimes act as a secondary lever. Based on the policies that planners use for their goals, these variables can be upgraded to influential variables, determining variables, or target and risk variables. These indicators play the most and most important role in regulating the relationships between variables for future forecasting of Tehran city, and

they can contribute a lot to the urban development of Tehran in the future by maintaining the balance between other indicators. These variables are among the regulatory variables of the research, which

include: reducing social problems, strengthening cultural places, developing group and council services, and demanding, the variables can be categorized as follows :

Table (5):

Classification of variables based on software output

Influential variables	Participatory clarification, popularization, privacy, creation of organic structure, agility, networking, and optimization of services
Bivariate variables	Hardware equipment, privacy, participation timing, participatory decision-making, crowdsourcing, attention to electronic government
Influential variables	Data and information exchange between citizens and related institutions, attention to the environmental field, the right to access information
Discrete independent variables	Information security, software infrastructure, specialization, implementation of green economy, workflow clarification
Discrete independent variables (near the origin of coordinates)	Aggregation of data and information, intellectual property of information, team-oriented, process transparency, process modeling, discipline.
Secondary leverage (above the diagonal cut) other	Education (citizenship), effective management, organizational innovation, knowledge-oriented, responsibility, law-abiding, commitment, Knowledge-based, Responsibility, Law-Oriented, Commitment
Regulatory variables (near the center of the diagram)	Reducing social problems, strengthening cultural places, developing group and council services, making demands

As it is known, the most key variable that has a high influence and is controllable and has a great impact on other variables is "the existence of various transportation options in the city". The ranking of variables according to influence is as follows.

Ranking variables, by impact.	
Rank	Variable
1	33-33
2	2-2
3	67-67
4	66-66
5	45-45
6	5-5
7	58-58
8	19-19
9	7-7
10	65-65
11	27-27
12	14-14
13	57-57
14	47-47
15	50-50
16	46-46
17	59-59
18	60-60
19	3-3
20	1-1
21	16-16
22	49-49
23	39-39
24	55-55
25	8-8
26	52-52
27	18-18
28	56-56
29	64-64
30	48-48
31	25-25
32	38-38
33	30-30
34	21-21
35	43-43
36	13-13
37	20-20
38	31-31
39	53-53
40	6-6
41	62-62
42	40-40
43	36-36
44	34-34
45	17-17
46	22-22
47	51-51
48	15-15
49	4-4
50	10-10
51	61-61
52	32-32
53	29-29
54	12-12
55	24-24
56	28-28
57	54-54
58	35-35
59	63-63
60	26-26
61	37-37
62	9-9
63	42-42
64	23-23
65	11-11
66	44-44
67	41-41

The ranking of the variables according to the influence (dependency) is as follows.

Ranking of variables according to the effectiveness	
Rank	Variable
1	12-12
2	53-53
3	4-4
4	40-40
5	48-48
6	2-2
7	24-24
8	56-56
9	58-58
10	59-59
11	62-62
12	68-68
13	80-80
14	17-17
15	38-38
16	7-7
17	18-18
18	49-49
19	27-27
20	16-16
21	8-8
22	3-3
23	13-13
24	50-50
25	10-10
26	57-57
27	1-1
28	9-9
29	64-64
30	22-22
31	58-58
32	37-37
33	54-54
34	45-45
35	39-39
36	32-32
37	60-60
38	31-31
39	55-55
40	14-14
41	5-5
42	47-47
43	33-33
44	8-8
45	18-18
46	28-28
47	49-49
48	14-14
49	69-69
50	34-34
51	21-21
52	30-30
53	31-31
54	70-70
55	61-61
56	40-40
57	67-67
58	23-23
59	43-43
60	29-29
61	41-41
62	42-42
63	56-56
64	11-11
65	25-25
66	44-44
67	20-20

### 7.Scenario writing

To identify the most important factors affecting the development process and its imaginable situations in the future, 20 experts in urban affairs and digital transformation were asked for their opinions, and finally, 7 main factors and 21 situations were defined by summing them up. These factors include clarification, central participation, culturalization,

intelligence, accountability, stabilization, integration, and structural measures.

The mentioned factors can be imagined in different situations in the future. According to the investigations, these situations are predicted in 3 modes. In the table below, you can see the different states of these factors, which are necessary for developing scenarios.

Table (6):  
Factors affecting development and its imagined situations

Dimensions	status code	Factors
Clarification	S1	The right to access information
	S2	Process transparency
	S3	Transparency of workflow
	S4	Process Modeling
	S5	
	S6	Discipline
Pivotal participation	M1	Crowdsourcing
	M2	Participatory Decision Making
	M3	Participatory Transparency
	M4	Timing of Participation
	M5	Development of group and council services
	M6	Popularization
	M7	
Cultivation	F1	Education (citizenship)
	F2	Reducing social problems
	F3	Strengthening Cultural Sites
	F4	Pay attention to social capital and social health
Intelligence	H1	Service Optimization
	H2	Exchange of data and information between citizens and related entities
	H3	Networking
Accountability	P1	Accountability
	P2	Law Oriented
	P3	Commitment
	P4	Demanding
Stabilization	I1	Attention to e-Government
	I2	Attention to the environmental field

I3	Implementing the Green Economy
Integration	
Y1	Software Infrastructure
Y2	Aggregation of data and information
Y3	Information Security
Y4	Privacy
Y5	Intellectual Property
Y6	Information Hardware Equipping
T1	Creating an organic structure
Structural Arrangements	
T2	Agility
T3	Specialization
T4	Knowledge oriented
T5	Team Oriented
T6	Organizational Innovation
T7	Effective Management

After determining the situations, the cross matrix of the mutual effects of these situations was formed and this matrix was completed again by asking the opinions of 13 experts, by inserting figures from 3 to -3. The number 3 means the most effect, the number 0 means no effect, and the number -3 means the most restrictive. By entering the final matrix of the mutual effects of the factors influencing the development (which is obtained from the mode of 13 other matrices) in the Scenario Wizard software version 3.41, several 2187 combined scenarios were extracted, which includes all possible possibilities in the future. Of course, all these scenarios cannot be analyzed and planned. With complex calculations, this software provides the researcher with the possibility of extracting scenarios with strong probability, scenarios with weak probability, and scenarios with a high probability of compatibility and adaptation, which are as follows:

## 8. Discussion and Conclusion

### 8.1. Strong or Probable Scenarios: 2 scenarios

According to the outputs of the software, two scenarios have obtained the highest score of total impact with a large difference from other scenarios and the software has considered them as strong scenarios. These two scenarios can be seen in the table below.

Table (7):  
Situations of strong scenarios

Scenario 1	
Make smart	Development of electronic services and businesses in domestic and foreign platforms (A1)
Central participation clarification	Putting people in charge of programs (B1)
Structural arrangements	Clarification in all matters of organizational departments (C1)
Integration	Agile and creation of organic and flat structures (D1)
culture building	Development of hardware and software infrastructure (E1)
Stabilization	Creating and consolidating the discourse of digital transformation (F1)
	Attention to the environmental areas and the green city (G1)
Scenario 2	
Make smart	Limitation of online services (A3)
Central participation clarification	Ignoring people in plans and programs (B3)
Structural arrangements	Maintaining confidentiality in administrative processes (C3)
Integration	Hierarchical increase in structural levels (D3)
culture building	Employing human resources instead of software (E3)
Stabilization	Ignore Discourse (F3)
	Neglecting environmental areas and the green city (G3)

According to the results, among the strong scenarios, one scenario includes the most favorable possible situations and one scenario includes the most unfavorable possible situations.

### 8.2. Weak Scenarios (Possible Scenarios): 71 scenarios

The software considers 71 scenarios as weak scenarios. Although it can be reasonable to deal with weak or possible scenarios, it is impractical to plan for such a high number of scenarios.

### 8.3. Compatible scenarios (believable scenarios): 6 scenarios

Considering the limitations of dealing with weak scenarios, it seems logical to use compatible scenarios that are between strongly limited scenarios and weak broad scenarios. It should be noted that in the settings

of compatible scenarios, the maximum amount of incompatibility is 2 units. Determining an inconsistency unit would make the proposed scenarios similar to strong scenarios. Based on this, 6 scenarios were obtained, which can be seen in the table below. The title of each situation is written inside each house, which can be followed according to the table "Factors affecting development and its imagined situations".

Table (8):  
states of compatible scenarios

	Scn 1	Scn 2	Scn 3	Scn 4	Scn 5	Scn 6
Make smart	A1	A2	A1	A2	A3	A3
Central participation clarification	B1	B2	B2	B2	B2	B3
Structural arrangements	C1	C2	C2	C2	C2	C3
Integration	D1	D2	D2	D2	D2	D2
culture building	E1	E3	E3	E2	E3	E3
Stabilization	F1	F1	F1	F2	F1	F3
	G1	G2	G2	G2	G3	G3

Based on the obtained results, the first scenarios are the best, and the sixth scenario and to some extent, the fifth scenario show the worst possible situations. The second to fourth scenarios are mostly based on the least changes in the main factors and show progress in only one factor and regression in one factor.

## 9. Research Suggestions

According to the obtained results, in line with digital governance in line with urban smartness with a sustainable approach, it is suggested to strengthen electronic services and businesses on domestic and foreign platforms; Community members from different strata and with different tastes should be at the head of urban affairs. Crowdsourcing platforms should be used for collaborative management and intellectual assistance of society's elite; Clarity should be put on the agenda in all administrative and organizational matters; Justice and per capita distribution of urban welfare and entertainment should be done among the members of the society.

## References

- [1] Abavaste, Simin, Rezazadeh, Masoomeh, Bostani, Maram. (2017). The Foresight of Urban Development with Infrastructure Development Approach. Quarterly Journal of Environmental Planning, No. 50.

- [2] Abolmaali, F. Daneshfard, Karamolah, Pourezat, Ali Asghar. (2020). Designing an administrative reform model with a digital governance approach. *Journal of Management of Public Organizations*. Vol. 8, No. 3.
- [3] Bikzadeh, J., Jalilinejad, Ghasem. (1401). Pathology of digital governance in e-government. *Elite Journal of Science and Engineering*. Volume 6, Issue 6.
- [4] Heydari, Saeed, Sepahvand, Reza, Nazarpouri, Amir Houshang (1401). Structural Model of Smart Cities with Comparative Approach and Citizenship Logic. *Iranian Journal of Political Sociology*, No. 27.
- [5] Khodadadi, A.R., Abbaspour, A.R. Modeling Digital Governance in Virtual Organizations in the Public Sector. *Iranian Political Sociology*, No. 12.
- [6] Hataminejad, Hosein. Mansouri Enamnian, Abul-Seasonal (2011). The Effects of Smart City on Livability of Cities. *The Vision of Future Cities*, No. 2.
- [7] Dadfar Shima, Bandar Abad Alireza. Assessment of the Strategic Plan of Tehran City with Futurism Approach. *Urmanshah Publications*. 1400; 14(37).
- [8] Rahbar Morteza, Mahdavinejad Mohammad Javad, Bemanian Mohammad Reza, Amir Hossein Central Medicine. Explanation of Environmental Sustainability Parameters Using Artificial Neural Network. *Sustainable Architecture and Urbanism*. 2019; 7(2): 169-182.
- [9] Rahsapar, Reza. Salehi, Keyvan. Ezzati, M. (2019). Identification and structural analysis of the interaction between the drivers of change in the field of education. *Quarterly Journal of Educational Innovations*.
- [10] RefWorks
- [11] The Prophet (s) was a prophet and a prophet. (2017). Sustainability in metropolises. *National Conference on Urban Management*.
- [12] Rahnama, M., Hosseini, M., Mostafa, Hamidi, Somayeh. (2020). Measurement and evaluation of smart city indicators in Ahvaz metropolis. *Human Geography Researches*. Vol. 52, No. 2.
- [13] Asgari Rad, Mohammad Reza Jahromi, Mansour. (1400). Presenting a Techno-Economic Model of Sustainable Communication Infrastructure in Smart City Using Fiber Optic Access Network. *Electronic Defense Journal*. Vol. 9, No. 1.
- [14] Narges Kandari, Narges. Rouhani, Saeed. (2011). Conceptual Framework of Digital Judicial Transformation in the Direction of Digital Governance. *Journal of Public Administration*., Vol.13, No. 3.
- [15] Salavarzizadeh M, Sheikhi Hojjat, Goldoosti Z. Identification and Analysis of Factors Affecting Urban Development with Foresight Approach (Case Study: Ilam City). *Human Geography Researches*. 1400; 4: 1508–1491.
- [16] Sayyah Mazoli Ardeshir, Asadi Alireza. Investigating the Intellectual Structures and Key Concepts in Futures Studies and Presenting a Framework for Future Studies Implementation. *Future Studies of Management*. 2014, 1926(102:):26-15.
- [17] Prayer and Prayer (2018). Analysis of Trends and Drivers Affecting the News of IRIB in the Next 5 Years. *Quarterly Journal of Communication Research*. No. 5.
- [18] Kazemi, Akhavan, Nikood Nazari, Ayub. (2018). Identification and Analysis of the Drivers of Political Development in Iran after the Islamic Revolution; An Informed Scenario for the Future. *Journal of Researches in Islamic Politics*, Vol. 6, No. 14.
- [19] A poor little girl. (1400). Explanation of Smart City Basics and Strategies with Sustainability Approach in the Field of Crisis Management. *Journal of Disaster Prevention and Management Knowledge*.
- [20] Albert Meijer, Manuel Pedro Rodríguez Bolívar, 2015. Governing the smart city: a review of the Literature on smart urban governance
- [21] Anisah Herdiyanti\*, Palupi Sekar Hapsari, Tony Dwi Susanto, 2019. Modeling the Smart Governance Performance to Support Smart City Program in Indonesia
- [22] Alica KALAŠOVÁ, Kristián ČULÍK, Miloš POLIAK, 2021. Smartphone-based Taxi Applications
- [23] Anna Visvizi, Miltiadis D. Lytras, Ernesto Damiani, 2018. Policy making for smart cities: innovation and socially inclusive economic growth for sustainability
- [24] DeLone, W., Migliorati, D., & Vaia, G. (2018). Digital IT governance. In *CIOs and the Digital Transformation* (pp. 205-230). Springer, Cham

- [25] Eivind Kristoffersen, Fenna Blomsma, Patrick Mikalef, Jingyue Li, 2020. The smart circular economy: A digital-enabled circular strategies framework for manufacturing companies
- [26] Hassan, S., Madad, A., Das, N., Akhtar, S., Jehan, N. J. B., & Research, E. (2019). Important dimensions of the digital divide: A case study of NADRA Portal Pakistan. *Business and Economic Research*, 9(1), 148–163
- [27] Indriasari, E., Supangkat, S., & Kosala, R., (2020). Digital Transformation: IT governance in the agile environment. *International Journal of Scientific & Technology Research*, 9(4), 45-55. <https://www.ijstr.org/paper-references.php?ref=IJSTR-0420-33813>.
- [28] Kamran Soomro, Muhammad Nasir Mumtaz Bhutta, 2019. Smart city big data analytics: An advanced review
- [29] Sulisty Aris Hirtranusi, etc, 2019. The Governance Strategies To Build Smart City Towards Digital Prosperity
- [30] Lina Linde, David Sjödin, Vinit Parida, Joakim Wincent, 2021. Dynamic capabilities for ecosystem orchestration A capability-based framework for smart city innovation initiatives
- [31] Nguyen Quoc Toan and Dao Thi Nhu, 2020. Smart Urban Governance in a smart city
- [32] Syed Asad A. Bokhari and Seunghwan Myeong, 2022. Use of Artificial Intelligence in Smart Cities for Smart Decision-Making: A Social Innovation Perspective
- [33] Rondik J. Hassan and others, 2021. State Art Survey for IoT Effects on Smart City Technology: Challenges, Opportunities, and Solutions