Structural and Legal Challenges of Policy making (Establishment and Development) of the Smart City in the Virtual age in Tehran

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Abstract

Throughout the evolution of humanity, various factors have influenced human life, enhanced its quality and sometimes posed threats. One could argue that humans have experienced nomadism, urbanization, and the industrial revolution, as well as technological transformation throughout the evolution of their lives. Just as the advent of machines transformed the face of cities, today, the introduction of technology and virtual services has revolutionized them. The theory of smart cities, based on information and communication technology, attempts to intelligently transform various layers of the city in order to address current problems and improve the quality of life. Despite the numerous advantages of smart cities, their implementation is considered challenging and complex. Many cities face failure in implementing smart cities. Therefore, a deep and systematic evaluation of influential factors becomes essential. This research aims to evaluate smart city policymaking in Tehran. The study employs an analytical and exploratory method to assess questionnaire questions on a Likert scale with a minimum score of 1 and a maximum score of 5. To determine the reliability and internal consistency, Cronbach's alpha coefficient is used. The research findings indicate that all the strategies and actions examined in this study, from the perspective of experts (specifically, the formulation and implementation of integrated policies, legislation, and a unified vision), are highly important for the smartification of Tehran. This article adopts a conceptual approach, framing the necessary framework for creating smart cities in observed changes in management style. With theoretical inferences from the sociology of change and the theory of the network society, good urban governance is proposed as a causal condition for creating a smart city in Tehran. The implementation of a smart city necessitates a change in the institutional and managerial structure of the urban system.

Keywords: Smart City, Policymaking, Structural and Legal Challenges, Tehran

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Introduction

The emergence of the global village, spanning several decades of its existence, has brought about significant transformations in matters related to the management and organization of entities. Unfortunately, our country not only did not contribute to its creation but also has not effectively taken steps towards utilizing the opportunities and tremendous achievements that have arisen. The adoption of information technology-based solutions has introduced new dimensions, and significant obstacles to the development of integrated information systems have been addressed with a focus on planning, service delivery, and control. Therefore, it is essential for the experts, managers, and policymakers of the country to pay more attention to the breadth, efficiency, and grandeur of the achievements resulting from the proper and principled implementation of such solutions. They should take determined and effective steps towards their deployment.

The comprehensive plan of smart city centers in Tehran is a cohesive collection of urban, technical, and civil engineering subsystems, urban services, revitalization, guilds, income, real estate, material control, and supervision over the construction by supervising engineers and archiving responsiveness to the most advanced geospatial information systems worldwide, provided by several experienced companies in the field of municipal automation as a consortium. It can be confidently stated that on the threshold of entering the sixth decade of the information age, the approach and demands of citizens towards organizations and service-providing agencies, such as municipalities, are being driven towards the goals of "everywhere, everyone, every time" and "easier, faster, cheaper" with determination.

Today, the criteria for development and competition revolve around the customer and success in ensuring and satisfying them. Based on this, the comprehensive plan of smart city centers in Tehran is being formulated in various phases with the aim of providing electronic services and transparency of its mechanisms. The Integrated Government System is designed and implemented to achieve automation in various units of the country's municipalities and cover the three levels of city information hierarchy: executive, managerial, and policy-making, as well as citizens.

Electronic development refers to the power and capability of accepting, using, and employing information technology and its applications in various human societies. There are numerous factors for measuring and developing the smart city, which need to be carefully evaluated. Nowadays, information technology and related communication technologies are rapidly advancing, and most countries around the world are currently benefiting from the capabilities of this technology. The application of information and communication technologies to provide urban services to society, known as a smart city, is a new initiative that aims to facilitate citizens' access to public services through electronic media and redefine government-citizen relationships in a new way.

The smart city marks the beginning of a new phase in the relationship between the government and citizens, successfully positioning itself among public sector reform programs and bureaucracy system reforms. This writing

aims to elaborate on some aspects of the smart city, such as the concept, taxonomy, reasons for formation, goals and necessities, advantages and applications, and the reasons for leaning towards the use of smart cities and the challenges ahead. Electronic government is a virtual organizational system that provides its services to citizens in the field of government responsibilities quickly, accessible, and securely using information technology. Its services are available 24 hours a day, independent of time and location restrictions within the city.

Literature Review

Vasja Roblek, Mirhanna Pajic, and Maja Mesko (2021), in their article titled "Technological, policy making and citizenship aspects in the development of smart cities," examine how cities cope with the concepts of smart city development and the implementation of an ecosystem within it. Sonnet Telsak and Vedat Elmas (2021), in their article "Smart City Component," assert that to make cities livable in every aspect, the interest in "smart cities" and research on using information and communication technology in related policy and scientific studies are increasing day by day.

Eddy Smits and colleagues (2020), in the article "Classifying pathways for smart city development: comparing design, governance and implementation in Amsterdam, Barcelona, Dubai, and Abu Dhabi," state that the emergence of the Internet of Things (IoT) as a new paradigm in Information and Communication Technology (ICT) and rapid changes in technology and urban needs encourage cities worldwide to formulate smart city policies.

Margarita Angelidou (2014), in the article "Smart city policies: A Spatial approach," provides a spatial perspective on examining the factors that distinguish policies for developing smart cities, offering a clear view of the strategic choices made when formulating such strategies.

Ahmad Ahmadpour, Karamollah Ziarati, Hossein Hataminezhad, and Shahram Parsa, in their article "Smart City: Requirements and Imperatives of Tehran for Intelligence in 2022," highlight that cities inherently face complex and extensive challenges. In the midst of this, the rapid growth of cities is not proportionate to the capacity of their infrastructure, imposing increasing pressure on urban infrastructure. Afsoon Mahdavi, in the article "An Analytical Study of the Role and Impact of E-Government Management on Perceptions of Smart City Concepts with a Transparency Approach in the Sustainable City of 2013," notes that with the rapid growth of the population and its concentration in cities, sustainable urban development is faced with a crisis that affects the future outlook of humanity.

However, considering the mentioned research for university researchers, smart city practitioners, and policymakers is useful. This article can serve as a version for policymakers without an effective strategy, while it is not a practical version for action in the field of smartization. Additionally, the study attempts to evaluate important topics related to the infrastructure of Tehran's smart city. The focus of this study is primarily on the necessary structures for smartening the urban environments of Tehran.

1. Conceptualization

1-1. Clarification and Expansion of the Concept of Smart City Centers

The widespread and complex urban issues, coupled with the continuous growth and development of cities, have transformed the management of urban affairs into a challenging task. In addition to issues such as the environment, transportation, safety, and urban planning, one of the crucial factors influencing and determining urban components is urban management. If a city is considered as an organization, there must be an element at its forefront responsible for future planning and current affairs management. This element is referred to as urban management. Many issues in cities require the presence of urban management to address them and respond to the demands in the areas of collective life, particularly in service and public infrastructure matters. Therefore, the existence of an organized structure, with specific formations, is necessary for tasks such as providing health and environmental cleanliness services, creating and maintaining green spaces, ensuring the safety of the city and its residents. Thus, urban management involves organizing factors and resources to meet the needs of city residents and includes planning, implementation, monitoring, control, and guidance functions that must derive their power from the will of citizens and social contracts (Veisi, 2011: 120).

Despite the similar nature of the concept of urban management with the concept of the municipality as the organizational entity in urban management, it is inevitable to address the concept of the municipality. The organizational element in the system of administering the affairs of the country's cities is a non-governmental public organization called the municipality. In one definition, it can be said that "the municipality is an organization that, using its natural rights and the authority granted to it by law, creates and manages public facilities, establishes and implements urban systems, and provides for the common local needs of its residents. It gives them the authority and representation to reasonably and fairly collect the costs of the services entrusted to it from the residents and service users. It must be formed based on the will of the citizens and social contracts" (Shokouhi, 2014: 54).

According to Article 5 of the General Accounting Law of the country, "the municipality is a public and non-governmental organization with legal personality, established under the supervision of the City Council, elected by the people, and the government's supervision through the Ministry of Interior to perform tasks specified in the municipal laws. In accordance with the definitions mentioned, it can be said that the definition of urban management (considering it equivalent to the municipality) is an organizational non-governmental entity established to fulfill the common needs of citizens at the city level by them and in accordance with the law. It operates independently and has organizational autonomy within the scope of its activities."

1-2. Bureaucracy Theory:

The Bureaucracy Theory is considered one of the traditional approaches to management. Max Weber, a German sociologist and prominent thinker, published most of his works in the late nineteenth century. Despite remaining relatively unknown until the 1920s when his works were translated into other languages, Weber's theories had a significant impact on

management and sociology disciplines. Weber primarily presented descriptive accounts of organizational structures, focusing on how organizational structures could be appropriately designed. His ideas and theories heavily influenced management and sociological fields.

Weber's studies were primarily focused on the German government of his time. He believed that individuals gained authority due to their specific social positions, status, and credibility, occupying significant and influential positions in the social structure of Germany, not necessarily based on their abilities and qualifications. He argued that organizations did not operate to their full potential, suggesting a need for a new form of organization to address this issue.

Creating a competitive environment requires the division of labor and assignment of responsibilities for each person, with the necessary authority. Each member must not only be familiar with their work and have the means to carry it out but also be aware of the limits of their job, not intervening in the tasks of others and not altering the organization's framework. In the bureaucracy system, the principle is that administrative members, in other words, organizational managers, must be completely separate from the owners of the means of production. Anything that belongs to the organization and is used within the administration should be entirely separate from the personal property of the employees. This separation ensures that employees of bureaucratic organizations remain immune to interference, resistance, and expectations from authorities or non-organizational individuals.

Regulations and guidelines must be well-defined. Weber not only sees this as a guide for employees but also believes that the formulation of regulations makes organizational members make decisions based on consistent directives and procedures. The existence of the hierarchy principle in administration leads to the establishment of supervision and oversight in the organization. Compliance with organizational principles and regulations is not subject to the discretion of events.

In summary, the Bureaucracy Theory emphasizes the need for well-defined rules, separation of organizational property from personal property, and a clear hierarchy to establish control and supervision within an organization.

1-3. Smart City:

One of the concepts that entered the literature of public administration with a novel meaning about two decades ago is the term "Good Governance." The subject of Good Governance, due to the vulnerability of political systems and disruptions in implementing indicators that confirm the principles of popular governance and good and accountable government, has been raised as an important and contemporary topic in development literature since the 1980s (Jahani Doulatabad, 2021: 94-59). Good Governance emphasizes the participation of three sectors: government, civil institutions, and the private sector. Due to this emphasis, public affairs and issues will be managed more transparently and optimally, facilitating proper and interactive communication between the mentioned three sectors. This, in turn, provides the groundwork for achieving good governance in economic, political, and

administrative dimensions (Manouchehri, 2015: 65). The World Bank defines Good Governance based on six indicators, including freedom of expression and responsiveness, political stability index, government efficiency and effectiveness, quality of laws and regulations, rule of law, and control of corruption (Rahnama et al., 2020: 589-611).

The management strategy of cities, due to the rapidly increasing trend of urbanization worldwide, has undergone significant changes and, based on this, the latest management strategy for cities called "Smart City" has been introduced. A smart city is one that is well-implementing forward-thinking approaches in its six dimensions (Smart People, Smart Mobility, Smart Governance, Smart Living, Smart Economy, and Smart Environment). It creates a smart city by combining smart assets and activities that are destiny-shaping, independent, and citizen-aware (Tehran Municipality Information and Communication Technology Organization, 2019).

2. Design, Construction, and Implementation Process of Smart City Components in Tehran

2-1. Design and Construction of Smart Components:

In general, several issues can be discussed and examined for the design of smart components. Initially, it is essential to carefully evaluate information society characteristics, such as literacy rates, computer literacy, and the level of interest in participating in information technology activities among the city's residents. Additionally, the financial and human resources should be investigated, along with the technological infrastructures of the municipality (such as the level of telecommunication networks, satellite communication stations, and international networks). Furthermore, determining the type of technology that achieves short-term and long-term goals, strategies, and policies is crucial. After assessing the strengths and weaknesses in the mentioned aspects, prioritizing a specific order for project selection and its execution, as well as determining the success factors, is necessary for evaluating the implementation of the intended plan.

Following this stage, coordination between the project officials of smart components, database owners, private joint-stock companies, and also identifying a set of civil institutions to serve these projects becomes essential. After considering these factors, creating a comprehensive program derived from a realistic perspective, clear and precise goals, as well as practical and effective strategies and tactics, is feasible. This plan includes determining desirable technologies and priorities that must be implemented at the beginning. It should be noted that the execution of the smart component plan should be carried out by individuals responsible for municipality projects (such as urban planning and bridge construction projects). Unfortunately, it has become customary in many societies for the implementation of smart component projects to be undertaken by computer companies. This is because software programs are delivered to project owners in the best possible way, and magical solutions with a beautiful appearance are suggested to solve municipality problems (Ghanbari, 2017: 156).

2-2. Implementation Methodology and Evolution of Smart City:

The implementation of smart city components occurs through several stages, including initiation, enhancement, interaction, transaction, and integration. The developmental stages of these municipal initiatives can be described as follows:

Initiation: The initial step in creating a smart city involves preparing a strategic document based on field studies of existing facilities, current conditions, and a comparative analysis of global initiatives and experiences in this field. Consultation with experts and opinions from the ICT sector, as well as acquiring the necessary technical infrastructure such as software and hardware, is crucial.

Enhancement: After the implementation of the electronic municipality in a straightforward manner, the capabilities of the municipality for visitor use, especially citizens, will be developed. Efforts will be made to meet the minimum requirements of citizens in the design of the municipality. Many e-governments worldwide have started their work by providing primary services on websites and updating infrastructures and staff training in this phase.

Interaction: In this stage, efforts are made to establish connections with reference sites in specialized areas, and the information of the site is made available in such databases. Websites and networks in this phase create the possibility of two-way communications, and people can easily connect with electronic governments. Additionally, facilities for citizens of other cities to use the capabilities and capacities of the municipality can be considered.

Transaction: In this step, electronic payment facilities are provided, enabling digital transactions.

Integration: In this final stage, the electronic municipality website is expanded, services needed by citizens are provided more actively, and the necessary services for citizens are made available or produced. In this phase, some services, such as urban information databases, are accessible to citizens through the Internet. In the integration stage, most services are available through websites, and citizens can access most municipal services through local networks or the internet. This phase lays the foundation for the establishment of a smart city. Most leading electronic cities globally, such as Toronto, Berlin, and Boston, are at the beginning of this stage. The creation of virtual organizations and remote execution systems is part of the future plans of electronic governments, where people's visits to government offices are minimized, and employees can perform their administrative tasks from any location (Pourahmad et al., 2018: 56).

3. Smart City Policy-making Process:

Strategic Document: The Data Flow Diagram (DFD) for the electronic city is the result of studies and research that serves as the first stage in the implementation of the electronic city with a focus on the required electronic city. Successful countries in urban and smart city development attribute their success to an appropriate Strategic Document as one of the initial actions in their four-stage development programs. The four development stages are outlined as follows: (Hans, 2020: 65)

Stage One:

1- Preparation of legislation.
2- Provision of internet facilities and the design of websites for government and private sector organizations.
3- Establishment of an appropriate organizational structure in the Ministry of Interior and the Organization for Management and Planning of the Country.
4- Increasing public awareness of citizens and government employees about the capabilities of information technology facilities.
5- Training a workforce specialized in information technology.
6- Establishing a network between executive devices in the city, equipping and upgrading the hardware and software of units.

Stage Two:

1- Providing electronic services to citizens.
2- Production, distribution, and use of electronic information in government and private units.
3- Developing specialized training for government employees and citizen education.
4- Reforming the urban management system and traditional procedures.

Stage Three:

1- Creating information interaction among executive devices.
2- Establishing informational interaction between citizens and executive devices.
3- Developing necessary standards.

Stage Four:

1- Creating integrated public systems at the level of administrations, organizations, and companies.
2- Establishing specific electronic transactions.
3- Information interaction at the national level with government devices and the private sector.
4- Information interaction with the global information society as citizens of the third millennium (government employees and citizens).

4. **Components Related to the Development and Implementation of Smart Cities:**

There are several components that, when combined, lead to a country's electronic readiness. Among these, four major components play a vital role in electronic readiness, and their special attention in any electronic readiness program is essential. These components include citizens, economic enterprises, governments, and infrastructure. All these components are interconnected and require coordination (Baronyovo et al., 2018: 96).

Details of these components are as follows:

a) Government:

Governments are among the most important elements of electronic readiness in countries. Therefore, it is crucial for the functions of the government to be coordinated with each other, and the challenges posed by the digital economy should be considered. Citizens must have easy access to government services, which will result in time savings. Electronic readiness without a national information

technology policy for various sectors, including education, health care, government, and the private sector, will not be achieved.

b) Infrastructure:

Electronic readiness cannot be achieved without reliable infrastructures in a country. Various infrastructures, similar to technical and communication infrastructures (including software and hardware), legal infrastructures, and human resource infrastructures, are essential. The existence of such infrastructures facilitates access to electronic readiness for the government, economic enterprises, and individuals.

c) Citizens:

This component includes human elements effective in a country's electronic readiness. Factors such as literacy levels and their inclination to accept information technology must be considered. Any effort to achieve electronic readiness in a country is undoubtedly aimed at providing necessary services to its citizens. Therefore, various educational programs related to the development of citizens' information literacy should exist to enable them to benefit from various information technology applications

d) Economic Enterprises / Companies:

Another component contributing to achieving electronic readiness is economic enterprises or companies. These enterprises must coordinate with each other to streamline the processing of their interactive processes. Companies need fast communication with governments and citizens to easily offer their products and services. Electronic readiness provides opportunities for their global development. The adoption of information and communication technology in daily operations enables companies to stay updated in various international markets, facilitating their participation in the global economy (Kia, 1386: 79).

5. Process Related to Smart Components Deployment and Development in a Smart City
- Drafting a program to define quantitative and qualitative development goals for ICT at the government level (including networks, hardware, systems, skills, etc.).
- Selecting an electronic readiness assessment model for the municipality based on the objectives.
- Performing an electronic readiness assessment.
- Preparing and drafting a strategy and an implementation plan based on the readiness results (ICTMP).

Implementing the program (ICTMP) (Harrison, 2019: 30).

Figure 2: The Process Operations of Smart City Readiness Development
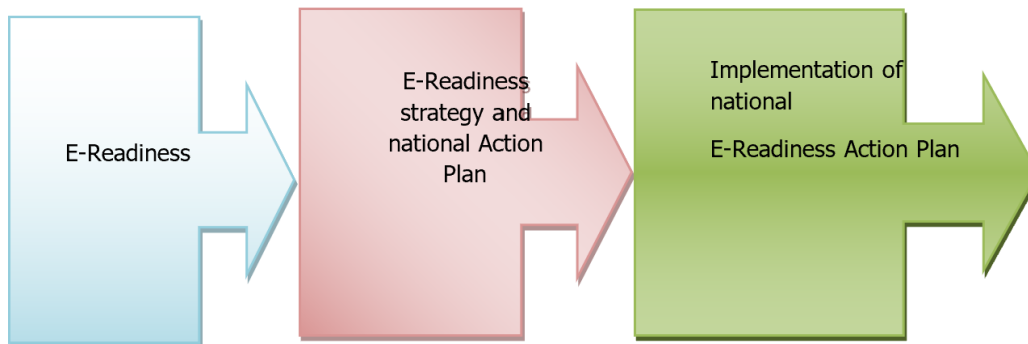
6. Description of the Conceptual Model of Research

Every conceptual model serves as a foundation for conducting studies and research, defining the variables of interest and the relationships between them. In other words, a conceptual model, or a mental map and analytical tool, ideally provides a strategy for initiating and conducting research. During the research execution, the variables, their relationships, and interactions between them are expected to be examined and tested. Adjustments may be made as needed, and factors may be added or removed.

To articulate the theoretical framework of the present research, after examining various models of e-readiness assessment, the selected method and model of evaluation, evaluation indicators, the structure of indicator weights, and the implementation plan in the government were chosen based on the model illustrated in Figure 3 and Table 1 (refer to Figure 3 and Table 1 for details).

Figure 3: Conceptual Model of the Research (Proposed Model for the Deployment and Development Infrastructure of Smart Centers in Tehran City) (Constructed by the Researcher)
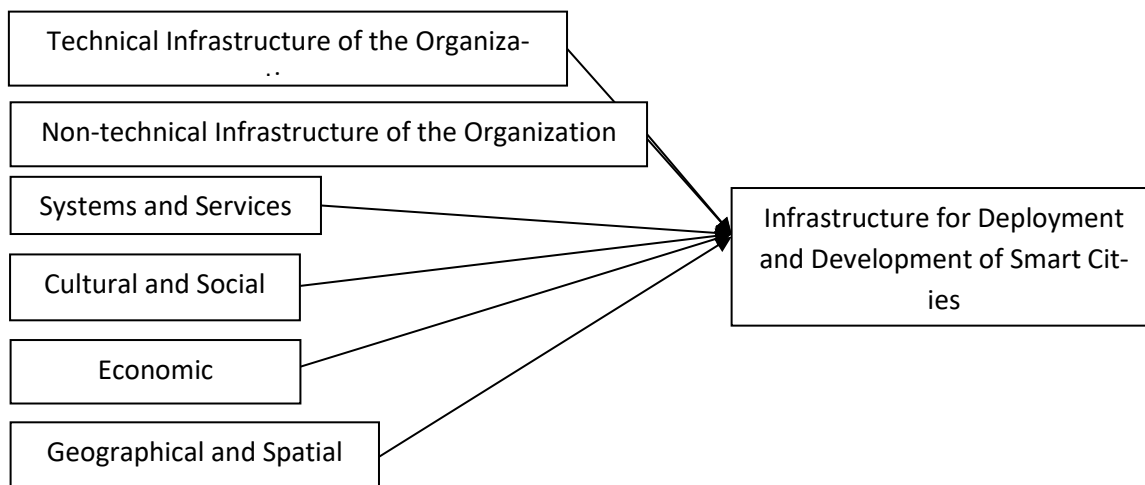

Table 1: Domains and Components Related to Each Aspect of the Research Model

Technical Infrastructure Dimension of the Organization	
Field	**Component**
Network	**Extent of the organization's internet network coverage (fiber, wireless)**
Hardware	**Level of technology in equipment** **Hardware penetration rate**
Support and security of hardware	**Development and implementation of necessary security standards and policies** **Availability of suitable security software** **Organization's attention to preserving individuals' privacy**
Non-Technical Infrastructure Dimension of the Organization	
Field	**Component**
IT Business Management and Strategies	**Precise and strategic planning aligned with the organization's business environment**

	Development of vision and policies related to the IT sector
	Coordination established between various departments involved in the project
	Level of support from senior managers for the project
Financial and Legal	**Amount of investments made in communication and network infrastructures**
	Prediction and presentation of financial and credit resources by higher-level institutions
	Formulation and implementation of guidelines and legal regulations related to IT at the organizational level
Human Resources in IT	**Utilization of skilled ICT workforce**
	Level of computer literacy among organization employees
	Practical capabilities of IT specialists

Systems and Services Dimension	
Field	**Component**
Functional Features of Software	**Coverage of business processes**
	User satisfaction with software
Coverage of software information	**Development and expansion of organization's software**
	Capability of running organizational software
Electronic Services Provision	**Utilization of suitable websites and portals**
	Provision and updating of sufficient content for informing and notifying citizens

Cultural and Social Dimension	
Field	**Component**

Education and Development	Amount of training provided to the public in the field of information technology
	Provision of educational and empowerment opportunities for organization personnel
	Development of social literacy in information technology
	Level of encouragement and incentives provided to the public for using electronic services
Access and Interaction	Level of interaction and transactions between users and the organization's website and portals
	Rapid and easy access to the organization's websites
	Level of collaboration between the organization and relevant institutions

Economic and Commercial Dimension	
Field	Component
Support for Electronic Services	Quality and cost of connecting to the organization's communication and information networks
	Responsiveness and handling of electronic complaints
	Provision of consultancy and organizational support for IT-centric services to the general public
Other	Ownership of equipment and technological infrastructure by the organization
	Value-added created through the development and expansion of electronic services
	Number of transactions conducted electronically
	Adoption of incentive and support policies to attract private sector participation

	Feasibility of creating stable income sources or funding part of the costs through the provision of electronic services
Geographical and Spatial Dimension	
Field	**Component**
GIS	**Optimal routing of city services** **Level of analyses conducted regarding spatial and temporal urban management** **Optimal location and selection based on density and needs of different city regions**

7. Research Methodology

To identify individuals for this study, considering that the primary responsibility lies with the municipality, after consulting this organization and reviewing the undertaken projects, the Head of Information Technology of the Tehran Municipality proposed experts and specialists from the Information Technology and Communications Department. Therefore, experts and specialists from the Information Technology and Communications Department of the Tehran Municipality constitute the statistical population of this research, and according to the available statistics, a total of 35 individuals were actively engaged in this governmental agency.

The statistical population of the present research, which guides and assists the researcher in collecting data and exploring issues in exploratory studies and problem-solving, is the managerial and specialist community of Tehran's metropolitan area (200 individuals). These individuals are experts and opinion leaders with expertise in political, diplomatic, and strategic areas, holding at least a master's degree and having a minimum of 15 years of work experience at strategic levels. Such individuals with these characteristics are limited, totaling 35, making the sample size compatible, purposeful, and all-encompassing.

One of the most important issues in sampling in any research is determining an appropriate sample size that ensures both generalizability and desirable efficiency. The sample size, using simple random sampling, will be 182 individuals.

On the other hand, considering the unavailability of accurate statistics for IT specialists and experts in the Tehran Municipality, it was decided to use the snowball sampling method to obtain the required data. In this method, the designed questionnaire was made available to all managers (sent via email), and while receiving the completed forms, they were asked to share the questionnaire with other managers

and experts in the field of technology or take measures to coordinate with them.

To assess the questionnaire items, a 5-point Likert scale was used, ranging from a minimum score of 1 to a maximum score of 5. To determine the reliability and internal consistency, Cronbach's alpha (α-Cronbach) coefficient was employed. Generally, the closer the Cronbach's alpha index is to 1, the higher the internal consistency and homogeneity of the questions will be.

In the present research, the reliability of the research questionnaire was assessed based on the reliability of its dimensions. The results are presented in Table 2. Due to the overall reliability index exceeding 0.70, the reliability of the questionnaire is confirmed across all dimensions.

Table 2: α-Cronbach Coefficient by Questionnaire Dimensions

Questionnaire Dimensions	Number of items	α-Cronbach Coefficient
Overall Questionnaire	**41**	**0.795**
Items related to Technical Infrastructure Dimension	**6**	**0.913**
Items related to Systems and Services Dimension	**6**	**0.898**
Items related to Non-Technical Infrastructure Dimension	**8**	**0.850**
Items related to Cultural and Social Dimension	**7**	**0.870**
Items related to Economic Dimension	**11**	**0.812**
Items related to Geographic and Spatial Dimension	**3**	**0.954**

8. Main Findings of the Research

8-1 Quantitative Description of Research Variables

8-1-1 Quantitative Description of the Smart City Services Variable

The values of descriptive indices for research variables are provided in tables (4-5).

Additionally, a histogram for the scores related to this variable is presented in figure (3).

Table (3): Descriptive Indices for the Smart City Services Variable (n=350)

Variability	Mean	Standard Deviation	Median	Minimum	Maximum
Smart city services	3.05	0.47	3	2	5

Given the table above, the average score of the questions related to each variable has been calculated as the value of these variables. Since the order of ranking the averages is in the form of (5-2.4, 2.4-4.3, 4.3-6.2, 6.2-8.1, 8.1-1), which corresponds to (Very High, High, Medium, Low, Very Low), based on the calculated averages, the variable of smart city services has an average value, meaning the highest accumulation of scores is in the middle range. This is also emphasized with other descriptive indicators and charts.

Figure 4 - Histogram for the Smart City Services Variable
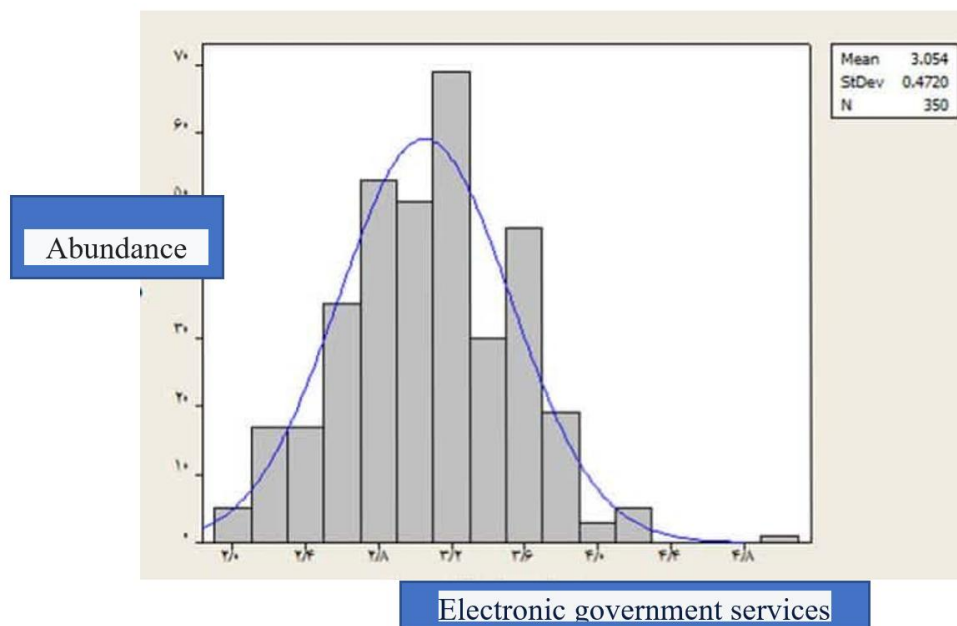
8-1-1-2. Quantitative Description of the Variable Structural and Legal Challenges of Policy-making in Smart Cities in the Virtual Age and Its Components

The descriptive index values of the research variables are provided in Table (5). Additionally, histograms for the scores related to these variables are presented in the above figure.

Table 5 - Descriptive Values for the Variable Structural and Legal Challenges of Policy-making in Smart Cities in the Virtual Age and Its Components (n=350)

Variability	components	Mean	Standard Deviation	Median	Minimum	Maximum
Structural and Legal Challenges of Smart City Policy Making in the Virtual Era		3.15	0.47	3.11	1.79	4.79
	Certainty	3.41	0.45	3.41	2.14	4.85
	Integrity	2.95	0.57	3	1	4.63
	Risk-taking	2.90	0.69	3	1.14	4.86

With regard to the above table, the average scores of the questions related to each variable have been calculated as the values of these variables. Since the order of ranking the averages is (5-2.4, 2.4-4.3, 4.3-6.2, 6.2-8.1, 8.1-1), which corresponds to (Very High, High, Moderate, Low, Very Low) respectively, considering the calculated averages, the variables of the challenges of structural and legal policies of smart cities in the virtual age and their empowerment components have high averages, meaning the highest accumulation of scores is in the high range. However, the components of integrity and the spatial structure governing Tehran have moderate averages, meaning the highest accumulation of scores is in the mid-range. The confidence component has a high average. This is emphasized by other descriptive indicators and diagrams.

Technological development has led to the restructuring of governance thinking, and since the scope of the technology city extends to all dimensions of knowledge, it has influenced decision-making patterns and approaches at various levels. Given that the space of

technology cities has a technological aspect, it has different patterns from other cities in the field of policy decision-making. Different patterns with different approaches for policy decision-making in technology cities have been presented by governments and companies. The governing approach in each country determines the decision-making pattern of technology cities in the country and in the execution and design of decision-making patterns in the space of these cities, decision-making patterns based on technology, especially virtual technology and government technology services, should be used. Analyzing the advantages and disadvantages of these patterns and also the conceptual capacity of two physical and virtual spaces governing government technology services in technology cities necessitates attention to both areas in choosing the superior pattern. In this regard, the selection of a multi-dimensional (hybrid) pattern, which includes all the characteristics, capabilities, and possibilities of both areas, can help citizens achieve the desired goal of technology cities.

Figure (6): Histogram for the variable Challenges of Structural and Legal Policies of Smart Cities in the Virtual Age
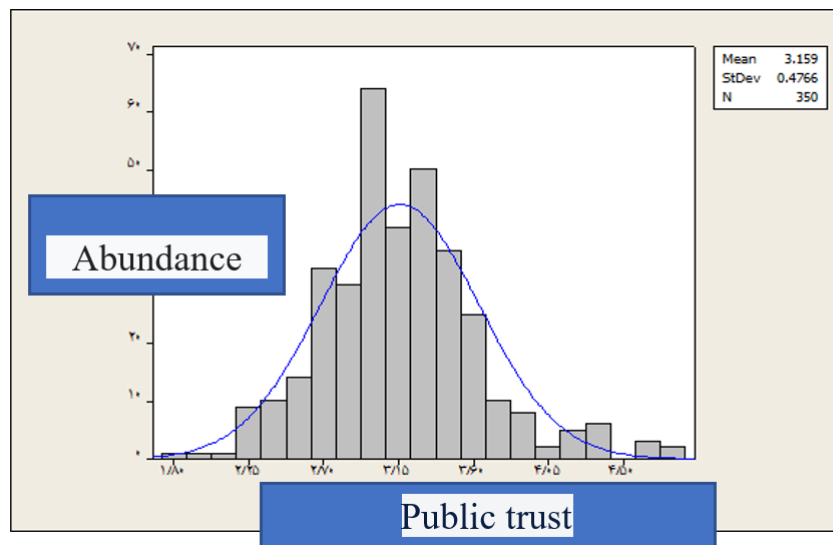
8-1-2. Data Analysis (Testing the Research Hypothesis)

Initially, before examining the research hypothesis, the normality of the research

variables must be investigated using the Kolmogorov-Smirnov one-sample test.

H_0 : The variable under investigation has a normal distribution.

H_1 : The variable under investigation does not have a normal distribution.

Table (5): One-Sample Kolmogorov-Smirnov Test for Research Variables

Variability	Number	Mean	Standard Deviation	z-score	significance
Smart City Services	350	3.05	0.46	1.023	0.246
Structural and Legal Challenges of Policy-Making for Smart Cities in the Virtual Era	350	3.16	0.48	1.342	0.069

Based on the results of the Kolmogorov-Smirnov one-sample test, the normality assumption for the research variables is confirmed with a 95% confidence level (p > 0.05). That is, with 95% confidence, the normality assumption is confirmed.

8-1-3 Research Hypothesis

There is a significant relationship between the effectiveness and efficiency of the bureaucratic system in empowering the components of smart cities through smart city platforms.

H_0 : There is no significant relationship between citizens' use of smart city services and the structural and legal challenges of policy-making in smart cities in the virtual age.

H_1 : There is a significant relationship between citizens' use of smart city services and the structural and legal challenges of policy-making in smart cities in the virtual age.

To examine the role of using smart city services and the structural and legal challenges of policymaking in smart cities in the virtual age, the Pearson and Spearman correlation coefficient was used (quantitative variables are normal). The results of this test are presented in Table (6).

Table (6) - Pearson and Spearman Correlation Coefficient between Smart City Services and Structural and Legal Challenges of Policymaking in Smart Cities in the Virtual Age

Correlation score	Correlation coefficient	Significance	Number	Existence of a relationship	Type of relationship
Pearson	**0.133**	**0.009****	**350**	**yes**	**Direct**
Spearman	**0.112**	**0.028***	**350**	**yes**	**Direct**

**At the significance level of 0.05, significant; *At the significance level of 0.01, significant

Based on the results of the correlation test, the Pearson correlation coefficient is 0.113, and the Spearman correlation coefficient is 0.112, indicating a significant relationship ($p < 0.05$) between smart city services and the structural and legal challenges of smart city policy-making in the virtual age. Since the calculated correlation coefficients are positive, it indicates a direct relationship between these two variables, meaning that with the improvement of smart city services, the structural and legal challenges of smart city policy-making in the virtual age also increase. This finding is supported by the scatter plot (Figure 7).

Figure 7: Scatter plot of Smart City Services * Structural and Legal Challenges of Smart City Policy-Making in the Virtual Age
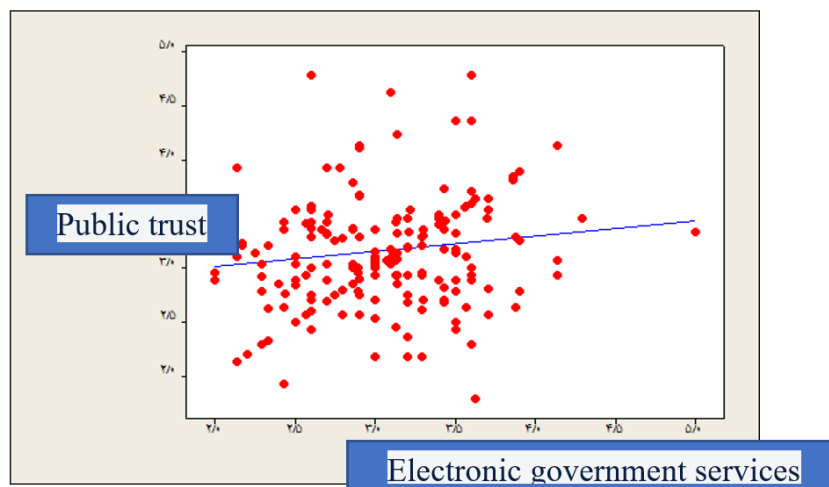
The urban space is a political place for citizens, and individuals become political due to residing in the city. Furthermore, in the city, political and institutional power over other vital dimensions of urban life is of special importance. In the context of semantic policy-making in a smart city, technology and cyberspace policy-making can be pivotal. Chang defines technology policy-making as 'a set of government actions in solving national problems or achieving national goals through technology,' and Fili et al., citing a scholar, consider technology policy as explicit and clear compatibility towards sustainable development. It should also be noted that all policy-making models for a smart city should be aligned with smart governance in all dimensions. Based on this, policy-making in a smart city can be seen as a set of actions for articulating, adopting, aligning, and promoting technology in a smart city for the benefit of citizens and achieving sustainable development in all dimensions. Policy-making in a smart city can be classified into two levels: national and governance level of the country, and the local or city level. These levels can be synonymous with Smith's classification, as two types: 'Vertical policy and Horizontal policy.' According to this classification, policy-making in a smart city includes the governing approach of the city at the national level, which can be considered as the vertical policy-making level, and at the horizontal level, it includes the adoption of cyber policy-making models in the smart city space, which can be considered as the horizontal policy-making level.

The political approach to the city is one of the most important approaches that has been of interest in various forms since the formation of ancient cities until today. Today, with the global expansion of the concept of a smart city, we witness different approaches to this issue worldwide. Generally, the mechanisms of policy-making in a smart city in each country define the 'governing system' in that country. These mechanisms follow the governance-citizen approach and are based on formal laws, policy-making procedures, and actions based on common principles and beliefs among the system, governing body, and citizens. Based on this, in different regions of the world, we observe different policy-making patterns for a smart city with a governance-citizen approach, which can be broadly categorized into three patterns: the American liberal pattern, the European participatory pattern, and the control pattern. Apart from this classification, in a more detailed and specialized perspective, we can identify specific patterns such as the public interest pattern, the free market pattern, the nationalist-cultural pattern of Europe, the developmental government pattern, and global patterns like the Cuban, Chinese, and Russian patterns.

Conclusion

In this section of the discourse, while referring to the results obtained from the analysis of collected data, the findings and their alignment with the results of other studies are explained. Finally, after the general conclusion, research limitations and recommendations are discussed. The present study aimed to examine the relationship between citizens' use of smart city services and the structural and legal challenges of smart city policymaking in the

virtual age among the citizens of Tehran. The study population included managers and experts in urban issues in the metropolitan city of Tehran (1400 individuals). These individuals are experts and opinion leaders with expertise in political, diplomatic, defense, and political geographical areas, holding at least a master's degree and having a minimum of 15 years of work experience at strategic levels. There are 35 individuals with these characteristics, making the sample size consistent and purposive, covering the entire population.

One of the emerging elements of the urban system that significantly influences its structures and functions is the introduction of smart systems and technology into urban management. This has led to the emergence of a new theory called the smart city in the global management literature. A smart city signifies the introduction of new concepts in urban planning. What propels a city towards smartness is not merely the use of electronic tools and communication systems but how these tools are planned and utilized to improve the quality of life for the city's residents. The Tehran Municipality, as a significant component of urban management at the national level, faces numerous challenges in the smartization of the city. Most of these challenges are rooted in the management style and perspective of the city. The process of formulating and implementing projects in the municipality is hierarchical, and the execution of projects does not follow a unified vision and law. The management style is governance, and it lacks two-way and flexible news communications.

This article has adopted a structuralist approach, framing the necessary framework for creating smart cities in the observed changes in management style. With theoretical inferences from the sociology of change and the theory of the network society, good urban governance is proposed as a causal condition for creating a smart city in Tehran. The implementation of a smart city requires a change in the institutional and managerial structure of the urban system.

However, in the upper-level examination of the policy dimensions in a smart city, attention should be paid to the governance system of the country, as mentioned above. Still, in the implementation and design of policies in the space of this city, attention should be paid to policies based on technology, especially cyber technology, in establishing local government. The cyber space affects all societies regardless of race, culture, and religion, and it has considerable potential to achieve the overall goals of a smart city. Also, due to the high interaction with this space nowadays, we witness phenomena such as cyber psychology, indicating the deep connection of the cyber space in all dimensions of human society.

Local government is a process that ensures that decision-making, execution, and supervision of local affairs are delegated within the framework of local government to institutions and public organizations. Yates Lauer defines local government as a ring of government that deals with the specific affairs of individual communities, cities, and individual neighborhoods. Johnston and his colleagues define local government in the book "Human Geography Culture" as follows: Local government refers to a set of institutions responsible for protecting and maintaining social relations at subnational levels. It includes local government, local judiciary, local affairs, local mechanisms, and other local administrative organizations. This system is used in managing the

affairs of large cities, local centers, counties, and provinces.

Local government is part of the national government apparatus that the necessity of avoiding local crises is the cause of its creation. Effective models in this strategy include web policy-making models. This article, in general, specifies that for Tehran to transform into a smart city, intelligent consultation with the people should precede any local and topical changes in the city. In fact, awareness, counseling, polling, and even empowering and delegating decision-making to citizens in the smart and dynamic city of Tehran are possible. As much as the facilities of information and communication technology in the smart and dynamic city of Tehran allow citizens to be involved, engaged, and have a say in all development projects and even in the formulation of the future city vision. Proper planning and coordination of the infrastructure (physical city infrastructure, Internet of Things devices, sensors, network infrastructure, and data analysis) improve the provision of services and efficiency. The development of technology solutions and adaptive use of technology for smart cities are necessary to respond quickly to the needs and demands of citizens. Smart city planning allows the sharing of resources and the use of citizen-shared programs to optimize services.

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