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Components of Smart Cities: Smart City Applications and Smart Space Management

Akıllı Şehir Bileşenleri: Akıllı Şehir Uygulamaları ve Akıllı Mekan Yönetimi

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Abstract: Increasing human activities and the need to be able to carry out increasingly rapid transactions and the need to quickly solve the problems in the city have brought smart and technological applications to the fore. With this study, it was tried to measure the awareness levels and expectations of the city residents regarding smart cities and e-applications in smart cities and smart city space management. Within the scope of the study, a conceptual framework related to the concept of smart city was presented; smart city components, smart space management policies, strategies and practices, and smart city application examples in the world and in our country were examined, a literature review was conducted and a survey was conducted with 252 people over the age of 18 in 2019. According to the results of the survey, it can be said that citizens do not have enough awareness about e-applications serving at local scale in our country. Therefore, it would be beneficial for local governments to inform citizens about local e-applications and to take a leadership role in smart space management.

Keywords: Smart Cities, Smart City Components, Smart Space Management, Smart Applications

Öz: Artan insan faaliyetleri ve giderek daha hızlı işlemler gerçekleştirebilme ihtiyacı ve şehirdeki sorunların hızlı bir şekilde çözülmesi ihtiyacı, akıllı ve teknolojik uygulamaları ön plana çıkarmıştır. Bu çalışma ile akıllı şehirlerde akıllı şehirler ve e-uygulamalar ve akıllı şehir alan yönetimi konusunda şehir sakinlerinin farkındalık düzeyleri ve beklentileri ölçülmeye çalışılmıştır. Çalışma kapsamında akıllı şehir kavramına ilişkin kavramsal bir çerçeve sunulmuş; akıllı şehir bileşenleri, akıllı alan yönetimi politikaları, stratejileri ve uygulamaları ile dünyadaki ve ülkemizdeki akıllı şehir uygulama örnekleri incelenmiş, literatür taraması yapılmış ve 2019 yılında 18 yaş üstü 252 kişi ile anket yapılmıştır. Araştırma sonuçlarına bakıldığında ülkemizde yerel ölçekte hizmet veren e-uygulamalar konusunda vatandaşların yeterince farkında olmadığı söylenebilir. Bu nedenle yerel yönetimlerin yerel e-uygulamalar konusunda vatandaşları bilgilendirmeleri ve akıllı alan yönetiminde liderlik rolü üstlenmeleri faydalı olacaktır.

***Anahtar sözcükler*:** Akıllı Şehirler, Akıllı Şehir Bileşenleri, Akıllı Mekan Yönetimi, Akıllı Uygulamalar

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1. Introduction

In the globalizing world, the optimal use of natural resources gains importance in the face of developing technology and increasing human activities. At this point, with the developing technology to keep up with the rapidly changing world, smart applications come to the fore both in personal devices and in buildings and cities.

According to the United Nations 2018 data, 55.3% of the world's population lived in urban settlements in 2018, and it is predicted that urban areas will host 60% of people on a global scale by 2030. Again, one out of every three people is expected to live in cities with a population of at least half a million, and urban population growth will continue. The urban population of the world is expected to reach 5 billion in 2028 and 6 billion in 2041 (UN 2018 ve UN 2019, 10). Therefore, the importance of the concept of smart city has increased with the aim of developing sustainable and livable spaces in order to cope with the environmental problems and to find solutions for these problems, caused by increasing human activities as a result of developing technology and increasing population and population density, especially in urban areas.

In this study a literature review and a face to face survey which includes multiple choice questions were conducted with 252 people over the age of 18 in 2019. With the survey, the citizens awareness level about e-applications serving at local scale in our country tried to be revealed. In other words, this study has been carried out more on awareness regarding smart space management. proportioning was done in the evaluation of quantitative data.

2. The Smart City Concept

Today, there are many different definitions for smart cities in the literature. Within the scope of the 2020-2023 National Smart Cities Strategy and Action Plan, Smart Cities are defined as follows: “More livable and sustainable cities that are implemented through collaboration between stakeholders, that use new technologies and innovative approaches, that are justified based on data and expertise, and that produce solutions and add value to life by anticipating future problems and needs.” . (T.C. Çevre ve Şehircilik Bakanlığı 2019, 19-20). In addition, smart cities are a process, rather than a static outcome, where increased civic participation, physical infrastructure, social capital and digital technologies make cities more livable, resilient and more responsive to challenges (BIS 2013). A smart city is a city that adopts an approach to solving public problems with ICT-based solutions on the basis of a multi-stakeholder and municipality-oriented partnership (European Parliament 2014, 24). Smart city; It is the use of all available information together, to better understand and control city activities, and to use limited resources effectively (Cosgrove *et al.* 2011). While a smart and sustainable city considers the economic, social, environmental and cultural needs of current and future generations; it is an innovative city that uses information and communication technologies and other tools to increase the quality of life, efficiency of the delivery of urban services and the and competitiveness (ITU 2016).

3. Components of Smart Cities

Looking at the components of smart cities in the world it is seen that different components such as; smart space management units, smart municipality services, quality management systems, planning, urban renewal and urban transformation project management systems, smart security and monitoring systems, risk, disaster and emergency management systems, smart transportation management systems, smart environmental management systems, smart health management systems, smart energy management system, smart infrastructure systems and smart education systems come to the fore.

In our country, within the framework of the 2020-2023 National Smart Cities Strategy and

Action Plan, the smart city components are; smart people, communication technologies, smart environment, geographic information systems, information technologies, smart space management, smart transportation, information security, disaster and emergency management, smart energy, smart governance, smart economy, smart structures, smart health, smart security and smart infrastructure (https://www.akillisehirler.gov.tr/akilli-sehir-bilesenleri/ 11.11.2020).

3.1. Smart Space Management Policies, Strategies and Practices

One of the smart city components is smart space management (https://www.akillisehirler.gov.tr/akilli-sehir-bilesenleri/ 10.11.2020). With the increasing population densities in cities, the activities performed by people in places are also increasing, and as a result, many problems such as traffic and environmental problems occur. In order to solve all these problems and to make the spaces resilient, livable and sustainable, smart space managements should be established. There are different definitions of smart space management in the literature.

In general terms, the smart space management, the ability of cities to be resilient against natural disasters, to be socially, culturally and economically livable and sustainable and to ensure development in accordance with the principles of urbanization (https://www.akillisehirler.gov.tr/ 10.11.2020 ve Akıllı Şehirler Beyaz Bülteni 2019:13). It can also be said that intelligent space management consists of space management units that use information and communication technologies to reach citizens more easily and to provide more effective and faster service, to promote innovation and cooperation among stakeholders in all fields regarding smart space management and applications, to ensure the creation of quality, durable and livable spaces and services and their sustainability, to ensure the participation of all stakeholders in the venue in the management and to create transparent, accountable, traceable and smart management systems.

The components and capabilities determined by taking into account the smart city management functions are as follows:

1- Governance: governance mechanism, organizational management, coordination between stakeholders, sustainability.
2- Strategy Management: strategy planning, roadmap creation and implementation, maturity assessment, monitoring, evaluation and change.
3- Policy Management: investment and financial management, identity and privacy management, information security management.
4- Holistic Service Management: service management, digital inclusion and channel management.
5- Business Management: solution development, project management, supply management, training and guidance, data ownership, sharing and interoperability, smart city architecture management, data, open processes and services, assurance and auditing (https://www.akillisehirler.gov.tr/olgunluk-degerlenen-model/ 11.11.2020).

Among the examples in the world, the institutions responsible for developing and implementing smart city projects are mostly city councils, municipalities or regional governments. In our country, municipalities undertake this role within the scope of public administration. Municipalities are the most important actors in the development of vision, mission and strategies for smart cities, the preparation of road maps and the implementation of projects. Today, municipalities are the managers, strategists, supporters, protectors, investors and solution providers of smart cities (Deloitte & Vodafone 2016, 29). Therefore, the most appropriate actors to assume the leadership role for smart space management in our country are local government units.

There are a wide variety of stakeholders and actors such as public institutions, universities, investors and fund organizations, non-governmental organizations and the private sector in smart cities. In order for smart cities to be functional and sustainable and to achieve their goals, they need to work in cooperation with stakeholders. Here, among the duties of public institutions; It has duties such as operating within the scope of its duties and authorities and following the processes, creating smart urban policies at the national level, bringing local governments together with investors and fund organizations. Investors and financial institutions are important in terms of providing the necessary financial support. Universities, R&D centers, service provider firms, techno towns and clusters are the other important stakeholders and actors in smart cities (Deloitte & Vodafone 2016, 31).

The Smart Space Management system is transparent; allows citizens to participate in the decision-making process and with its information and communication technologies infrastructure, it makes it easier for citizens to access information and data about city administration. Smart space management includes different applications such as providing government services through web-based platforms, monitoring public safety, ensuring citizens' access to data and documents, providing emergency and intervention and transportation management, and creating policies. In order to achieve all these, it is important to establish interconnected sub-management systems (Alawadhi *et al*. 2012; BIS 2013; Singh Kalsi & Kiran 2013; Hollands 2015; Johnson *et al*. 2015; Regional Publications 2014; Yin *et al.* 2015; Diego Giron 2018; Yousefimehr 2019, 27).

It is necessary to establish a smart city coordination center and sub-management units for smart city components within the smart space management units, and to exchange experiences with different smart space managements (Boz & Çay 2019). At this point, in order for all smart space management components to work in coordination and integrate with each other, it is important that local governments assume the leadership role and ensure centralized management and coordination.

Features of the smart management system are; to be flexible, pragmatic, dynamic, networked, smart, digital, collaborative, participatory, innovative and agile. While strategic dynamics, inter-institutional cooperation, creating smart citizenship and network systems, and inter-sectoral cooperation constitute the other dimensions of smart management; technological infrastructure, leadership, policies and legal framework, institutions, practices/co-creation, capacity building, citizen participation and innovation finance are also important drivers of smart and open management (Melhem 2012; Jšiugždinienė *et al*. 2017; Sarker *et al*. 2018). Every government agency needs to adopt big data technology to reduce threats and challenges, increase efficiency, accountability and transparency (Sarker *et al*. 2018).

Another important feature is; In order to ensure smart growth, competitiveness and innovation, it is necessary for smart space managements to participate in international and / or national related events and / or organizations and to be active in cooperation with various institutions and organizations. The participation of smart city governments in relevant international and/or national events, organizations and/or collaborations can also facilitate accessibility to the necessary financial resources for the smart growth of cities.

Governments and public institutions try to interact with citizens through smart applications and provide access to open data through smart space management systems (Garcia *et al.* 2014, 12; Örselli & Dinçer 2019, 99). Thus, while transparency increases in the decisions taken and the activities carried out, the citizens have more say in the administration. Therefore, the concept of smart management enables the citizens to be an effective stakeholder (Örselli & Dinçer 2019, 99). At this point, in order to ensure the participation of citizens and sectoral stakeholders, their access

to the services provided by information and communication technologies is required and they need to have the necessary skills as smart citizens in order to use these technologies (Boz & Çay 2019). However, in the face of these widespread access opportunities, smart space managements must also be resistant and prepared against cyber attacks. Therefore, it is very important to ensure information and document security.

3.2. Smart Space Management Applications in The World

In world examples, it is seen that cities have a smart city vision. For example, Barcelona's smart city vision; to be a self-sufficient city that lives at human speed in an efficient environment and produces zero emissions (Deloitte & Vodafone, 2016, 89; Barcelona Smart City Website 2020). Copenhagen's smart city vision; is to be the best city in the world for cyclists, where it is clean, healthy, has no carbon emissions, green areas and water resources come to the fore (Deloitte & Vodafone 2016, 95; Copenhagen Technical and Environmental Management Office 2015). Jakarta's Smart City Vision is; to be a city which residents live in a safe, comfortable, prosperous, productive, sustainable, globally competitive city (Deloitte 2015; Deloitte & Vodafone 2016, 100).

To look at examples of good practice in the world; Barcelona uses information and communication technologies in order to present an efficient, accessible, transparent and effective approach in the management process. Barcelona particularly attaches importance to the participation of city residents in smart city projects (Angelidou 2016, 23-24; Örselli & Dinçer, 2019, 100). Barcelona, with the 22@Barcelona project, carries out smart city applications in an area of two hundred hectares, with an investment of 180 million €, in order to become a smart city. The project is a successful example of finding solutions to the problems of information society and urban renewal (22barcelona Web Site, 11.11.2020 and Örselli and Dinçer, 2019:101). The aim of the project is to promote research activities related to smart management of urban space and e-services. At this point, the city council supports these urban studies by providing human resources and tools. Therefore, the main goal is to improve urban management; to cooperate with companies and institutes for new product development studies (Bakıcı *et al*. 2013, 142; Örselli & Dinçer 2019, 101). In addition, Barcelona provides an open data service for smart governance, and with this service, many information and databases that citizens can access, such as public information, statistical data, and analysis results of studies, are available (Örselli & Dinçer, 2019, 101; Barcelona's Opendata Service Web Site, 13.11.2020). Thus, thanks to the open access of data, information is provided to businesses that want to invest from all over the world (Örselli & Dinçer, 2019, 101). In addition to these, by establishing the Barcelona Decidim Platform; ensures a participatory and transparent management approach. With this application, it is possible to monitor and follow the services made for the city with open sources. In addition, with an open budget application, access to the expenditures and budget items made by the Barcelona Assembly is provided. In addition to these applications, with Ethical Mailbox, city dwellers have the opportunity to transmit instantly the negative behaviors that they encounter in the management (Barcelona Digital City Web Site, 13.01.2018; Örselli & Dinçer 2019, 102).

Smart city managements use internet-connected devices such as smartphones, tablets and computers and different tools such as cameras and sensors. According to the data obtained from these tools, smart city governments take faster, more effective and healthy decisions. From this point of view, municipalities can establish operation centers in cities and coordinate the relevant units from here, and they can monitor many points in the city and examine the data coming from them. For example, in the Rio Operations Center, 18 different units of the municipality were brought together. The city's security, event coordination, cleanliness are examined in real time with Google satellites and street maps and intervened when necessary (Deloitte & Vodafone 2016,

84; Deloitte 2016).

Effective and transparent budget and financial control is of great importance for city governments, as open data and city-related applications allow stakeholders to evaluate public expenditures and compare them with other city governments. This increases the trust of the stakeholders to the management units and the budget balance and the measures taken against corruption can be followed transparently by other stakeholders strengthens the cities economically. For example, the New York city government, after the bankruptcy in 1975, centralized the accounting system and started to track every payment. In addition, this system has been opened to the use of citizens. All users access the system through the links provided by the companies. Other indicators in line with social policy targets can also be monitored with smart applications (Deloitte & Vodafone 2016, 85).

Another component of smart management is easy, practical and efficient smart payment systems. While these systems keep records of citizens and government institutions in identity verification systems, they also record payment transactions. Thus, the principle of transparency is also supported. Again, with these systems, individuals do not lose time for payment transactions. The internet connection required for the mentioned systems is provided by the telecommunication companies. While using these systems, municipalities encourage citizens to adopt and use smart payment systems. In London, for example, the cards people use on public transport can be paired with credit cards. In addition, public transport crossing points also accept contactless transactions provided by credit cards (Deloitte & Vodafone 2016, 85).

On the other hand, Singapore has two innovation zones, the Punggol Digital District and Jurong Innovation District, which are home to more than 500 start-up companies, to provide a basis for developing public-private partnerships. These regions aim to develop new industries such as cyber security and advanced manufacturing; appear as examples of smart specialization (Eden Strategy Institute and ONG&ONG Pte Ltd., 2018:35). Therefore, it is important that smart space managements support and encourage clusters and/or incubation centers, especially related to innovation and technology, with a comprehensive approach.

3.3. Smart City And E-Municipality Applicatıons And Space Management In Our Country

When we look at the smart applications in our country, it is seen that different applications have always been carried out independently of each other in the past. This has created a disadvantage in terms of both the increase in costs, resource and time consumption and the inability to ensure sustainability and integration. Therefore, it is important that smart applications work in an interactive and coordinated manner with each other locally and regionally, both at the neighborhood scale and at the regional scale (TBB 2020).

Smart city applications in many areas such as transportation, energy, water and waste management are mostly within the application areas of municipalities in Turkey. A wide variety of applications are included in smart space management applications in Turkey such as traffic density maps, smart parking applications, Rapid Transit System, Automatic Pass System, Electronic Inspection Systems, vehicle tracking systems between the smart transportation and traffic applications and providing internet infrastructure, smart meter readings and chip garbage containers or waste bins etc between the smart infrastructure systems. In addition to these, within the scope of smart environment; solid waste facilities have electricity generation from methane gas, air quality monitoring system, noise control monitoring and warning system, excavation vehicles tracking system, operation of water wells with solar energy, smart infrastructure and water networks applications, lighting of parking areas and bus stops with solar energy, availability

of electric buses and solar-powered meteorological stations, environmental management information systems exist in our country. In addition, within the scope of smart transportation; smart public transportation systems, smart stops, smart intersections, smart traffic operating systems, providing public transportation with contactless banking cards or city-specific cards used in cities, smart bicycle and scooter transportation systems, early warning systems for icing, catenary-free tram systems, underfloor heated bridge intersections and pedestrian overpasses, elevators in pedestrian under and overpasses, electronic height monitoring systems exists in our country also. There are security cameras and intersection cameras, city security management systems, facilitating smart applications for disabled people and cemetery information systems which can be present in many public spaces today, to ensure the security of the city. In addition, within the scope of e-municipality and smart management, mobile municipality applications, municipal automation systems, vehicle tracking systems, municipal business tracking systems, revee information systems, municipal police management and control system, fiberoptic infrastructure systems, city information systems, maintenance and repair systems, smart communication systems, mobile water network control tools, water wells automations in the parks and gardens exist in Turkey (World Intelligent Cities Summit 2017).

Local government units are the most suitable actors to assume the leadership role for smart space management in our country. Therefore, the existence of smart municipal services and the widespread access of citizens to them are very important.

Smart municipality, in general terms, means the provision of municipal services independent of time and place, with a sustainable business management approach, by providing more access to citizens. The features of smart municipality include the existence of solution-oriented management, transparency, provision of e-participation services, accountability, traceability of all processes, and performance monitoring and development activities (World Intelligent Cities Summit 2017).

In smart municipal services; there are e-payment applications, e-zoning, sms and e-mail municipality, e-iskan, city guide applications, management information systems, e-signature and other e-municipality applications. In addition to the e-government applications that are frequently used in our country, e-democracy is also used by different countries today. E-democracy applications are on different platforms in order to ensure the participation of citizens in decision-making processes within the examples of smart urbanism. Therefore, the use of big and open data is very important.

Every transaction made on the Internet; messaging, location notification, transactions in e-apps, etc. It is recorded by sensing devices (McKinsey 2013, 9; Örselli & Akbay 2019, 233). Every transaction or every data recorded by modern information and communication technologies such as smart objects and devices, network sensors, web and social media creates big data (Rabari & Storper, 2015, 28; Örselli & Akbay 2019, 233). Storage and processing of big data are important elements of smart city platforms (Kes Erkul, 2017, 3; Örselli & Akbay, 2019, 233). Big data offers the opportunity to make more information-based decisions for social interaction (Batty 2013, 277). In order for smart systems to produce solutions, by analyzing the data collected from many sensors, should be transformed into value-added information (Örselli & Akbay 2019, 233). In addition, data obtained from different sources, such as social networking sites, surveys made or commissioned by the government, and face-to-face interviews, are collected in data warehouses and analyzed by government units in different sectors (Sarker Wu & Hossin 2018) .

Open Data is basically; It is defined as data that is freely and independently used by everyone. Open data is not subject to any copyright, patent or other control mechanisms (Akdamar 2017,

46; Örselli & Akbay 2019, 233). Open data, which can be read by computer and used by everyone and can be republished, increases the quality of work and competition in many sectors (Deloitte 2016, 34; Örselli & Akbay 2019, 233). Moreover, the development of open data and data sharing is also a requirement for the development of e-government applications in Smart Cities. (Correia & Wünstel 2011, 16).

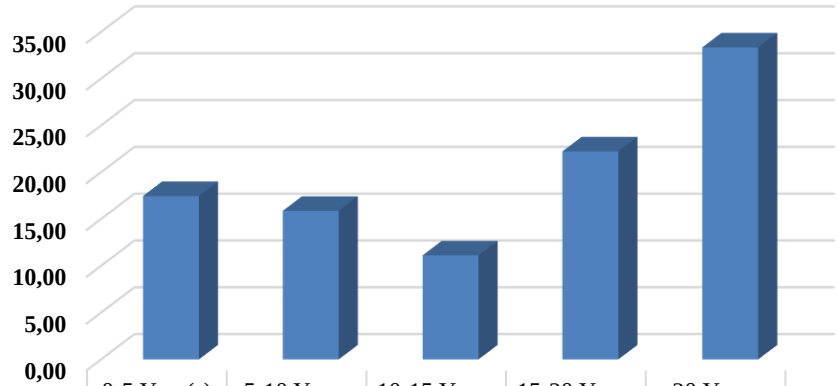
4. Smart City Survey Results

Within the scope of the study, the awareness level of citizens regarding smart cities and smart municipal services has been revealed. In this direction, a survey was conducted with 252 people. The people who were surveyed were selected by the Random Sample Selection Technique. The people surveyed live in different provinces of Turkey.

Looking at the results of the surveys; it is seen that the surveyed people have superficial knowledge about smart cities and that the municipalities and institutions do not inform the public about smart cities enough and they do not organize adequate activities such as events and training. Similarly, it is seen that the public does not have enough information about e-Municipal services, and there is insufficient informing on the subject, people should be informed more about smart cities and e-municipal services and the media should give more space to this issue on the screens.

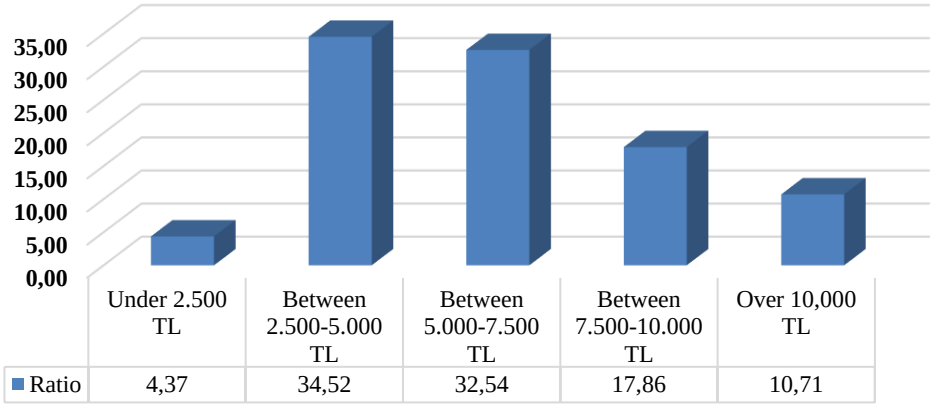
Looking at the results of the surveys; the majority of people surveyed live in Ankara. The number of people living in Ankara and answered the survey is 146. 17 people living in Istanbul and responding to the survey. The rest are living in Trabzon, Antalya, Denizli, Mardin, Samsun, Zonguldak, Düzce, Adana, Yozgat, Erzurum, Sinop, Sakarya, Aydın, İzmir, Malatya, Artvin, Muğla, Kırklareli, Elazığ, Eskişehir, Amasya, Isparta, Ağrı, Karabük, Hatay, Bursa, Kayseri, Ordu, Sivas, Manisa, Kahramanmaraş, Adıyaman, Şanlıurfa, Hakkari, Tekirdağ and Kocaeli provinces. As can be seen in Graph 1, the majority of the 252 people surveyed, constituting approximately 33.34%, have been living in their place of residence for more than 20 years.

Graph 1. How many years have you been living in your place of residence? (%)

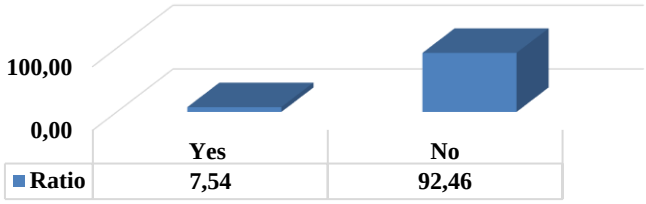


When the average monthly household income of the surveyed people is examined, it is seen that it mainly varies between 2,500 and 7,500 TL, as seen in Graph 2. Also as can be seen in Graph 3, only 19 people out of 252 have information about the 2020-2023 National Smart Cities Strategy and Action Plan.

Graph 2. What is your average monthly household income? (%)



Graph 3. Do you have any information about the 2020-2023 National Smart Cities Strategy and Action Plan? (%)

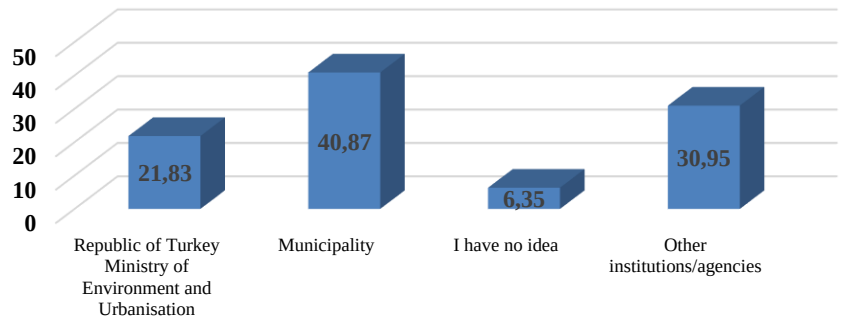


The respondents were asked whether they are satisfied with the smart city applications of the municipalities in their places of residence. Looking at the results of the survey, it is seen that most people are not satisfied with the smart city applications of the municipalities where they reside. In addition, some respondents stated that municipalities do not provide sufficient information to citizens about the practices and also stated that municipalities should give more importance to smart city applications. In addition, they stated that the bus is not at the stop during the estimated arrival time given in the transportation-related applications in some provinces, the wi-fi connection cannot be established everywhere and the applications are insufficient. As can be seen in the graph, the rate of people who are somewhat satisfied with the smart city applications of the municipalities is higher than the others with the percentage 48.81%.

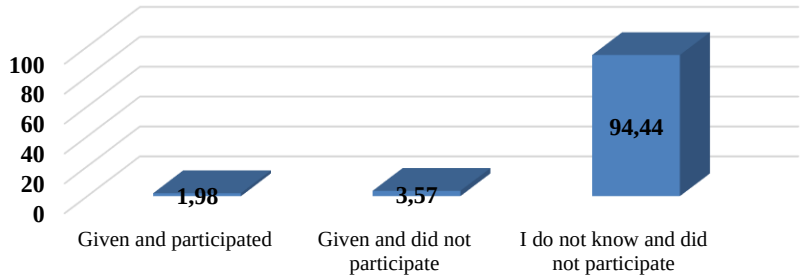
Graph 4. Are you satisfied with your municipality's smart city applications? (%)

The survey respondents were asked which institutions and/or organizations should assume the leadership role in the management of smart cities. According to the answers received, a large majority think that municipalities should assume this leadership role. However, the notable issue here is that the number of people who gave the "other" as the answer is quite high. It can be said that there is a confusion in the society related to this issue. Because those who gave the other answer stated that very different units should take on this leadership role such as private companies, district governorships, governorships, other ministries, technology companies, foundations, institutions related to safety and security, chambers of architects and engineers, educational institutions, agencies, non-governmental organizations. In addition, some other respondents stated that the relevant ministries, municipalities, city councils, the private sector, related and/or related institutes, non-governmental organizations and other relevant organizations should assume the leadership role together and the support of the media is also important. In addition, some people who gave the other answer also stated that a new organization should be established for this role and even a network connecting all institutions and organizations should be established, so that a more effective and efficient leadership role can be provided. Therefore, it is important to increase the awareness of the public in relation to the subject in order to ensure public participation in future smart city studies about which units should assume the leadership role in smart cities.

Graph 5. Which institutions and/or organizations should assume the leadership role in the management of smart cities? (%)

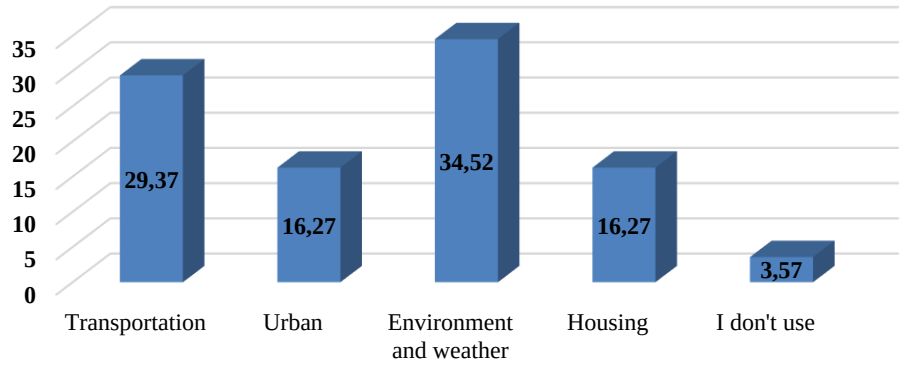


Graph 6. Have the municipalities, institutions or organizations in your district provided awareness or information training on smart cities and building systems? If yes, did you attend? (%)



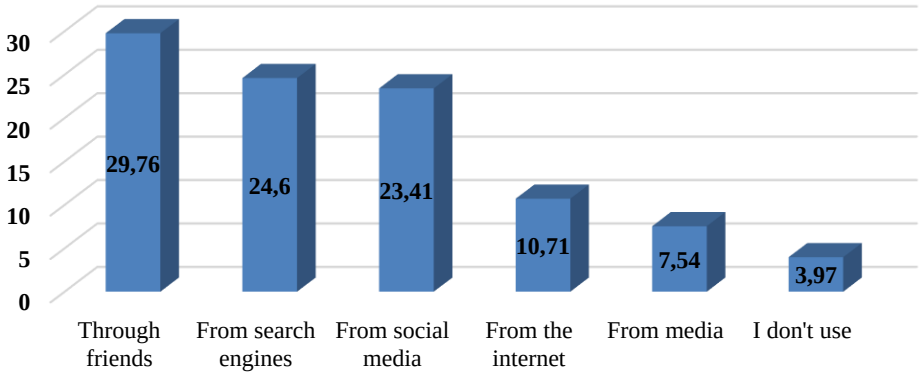
As seen in Graph 6, only 5 people participated in the awareness raising or information trainings about smart city and building systems of municipalities, institutions or organizations in their districts. The respondents stated that it would be very beneficial for municipalities to provide such services and that these trainings should be announced to the public in order to raise awareness.

Graph 7. Which smart applications do you use more frequently in your daily life? (%)



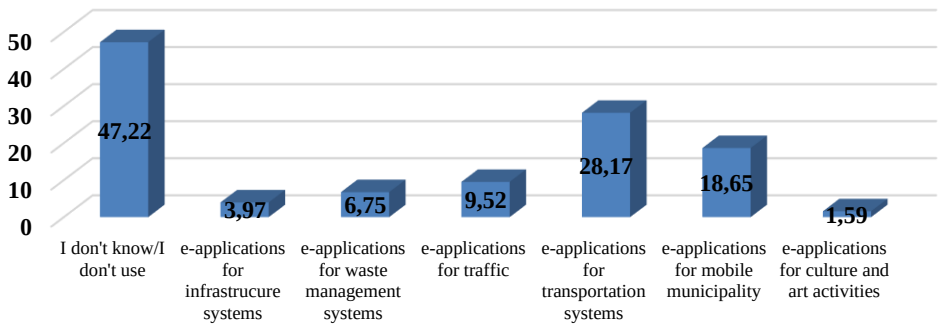
As seen in Graph 7, the people surveyed mostly use smart applications related to environment, air and transportation; they also stated that among the smart applications related to the city, they mostly use smart applications related to education and health issues.

Graph 8. From who or through what did you first hear about smart city applications (e-applications)? (%)



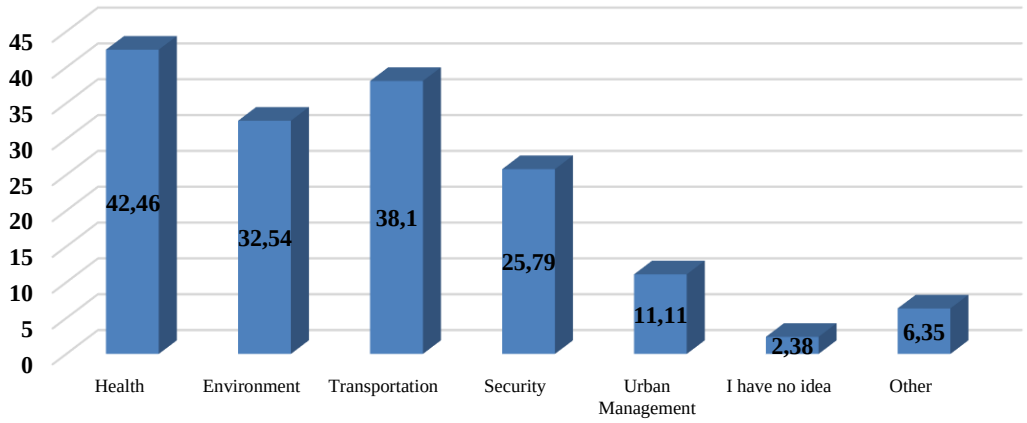
Looking at Graph 8, approximately 30% of the 252 people surveyed stated that they first heard of smart city applications through their friends. These people also stated that the social environment has a greater impact on being aware of the aforementioned applications.

Graph 9. What types of e-applications are used in your province or district? If you know, please specify. (Multiple types can be specified.)



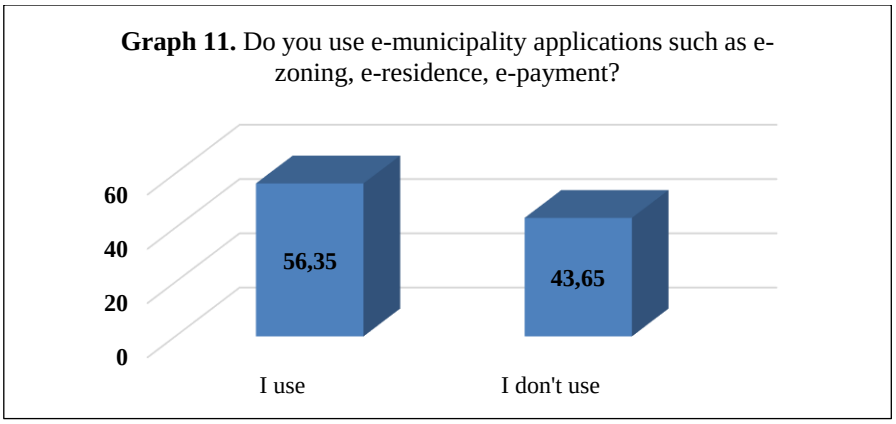
Looking at Graph 9, 119 out of 252 people who participated in the survey, in other words, the majority of them, stated that they do not use and/or do not know e-applications used in their place of residence, on a local scale and/or in provincial or district municipalities. This, in general, reveals the necessity of local governments to provide more information to citizens about e-applications. This rate is followed by people using e-applications related to public transportation systems with a rate of 28.17%, mobile municipality with a rate of 17.06% and other transportation systems with a rate of 9.52%. Among the e-application types specified here as other transportation systems, there are applications for traffic, parking spaces, scooters and bicycles. Among the people surveyed, those who stated e-applications related to smart waste management systems mostly stated the smart waste containers systems.

Graph 10. In your opinion, on which topic or subjects should local e-application or applications be created most in your city? (Multiple options can be selected.)



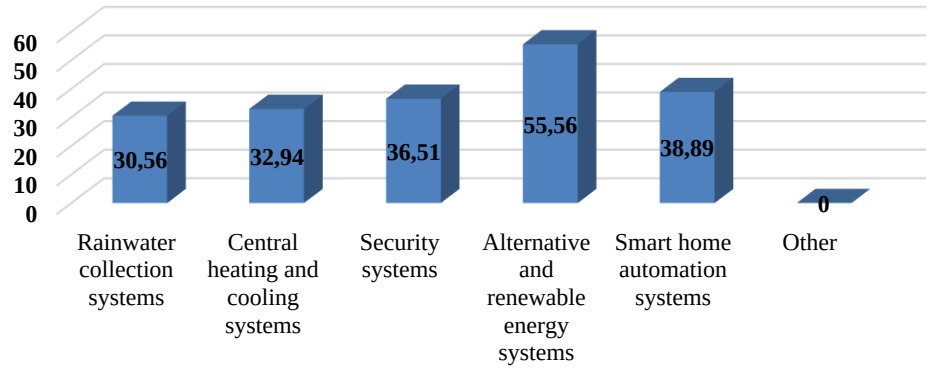
As seen in Graph 10, most of the people surveyed stated that the most health-related e-applications should be created in their city of residence. In addition, they said that there should be e-applications on various health-related sub-topics, such as questioning the current occupancy rate in hospitals or the possibility of meeting with doctors online. This subject is followed by the following subjects; transportation, environment, security, city management and other issues respectively. The people who were surveyed showed various transportation and environmental problems in the cities as the reason that transportation and environment issues are higher in proportion immediately after the health issue. In order to be able to walk in safer areas, some people surveyed stated that an e-application that shows places with more public lighting and cameras would be very useful. Among other subjects; Internet infrastructure, education, economy, tourism, city planning, cultural and social activities and events, communication, job postings and collaborations are specified. In addition to all these, there have been some people who stated that if an e-application is created, where opinions, suggestions and complaints about cities can be communicated up-to-date, they can respond more quickly to the problems experienced in cities. Very few people expressing the opinion that they are not sure about the subject.

In the 21st century, where developing technology and globalizing commercial activities are increasing, it is necessary to increase the awareness and knowledge of the citizens living in our country about e-municipality applications in order to save both energy and time.



Graph 11. Do you use e-municipality applications such as e-zoning, e-residence, e-payment?

Because, considering that the people who stated that they do not use e-municipal applications among the surveyed people vary in terms of age, some of them stated that they had never heard of these applications and some of them stated that they did not use such applications but their parents use. The people in the aforementioned group mostly stated that they went to the municipality and carried out their transactions. On the other hand, it is seen that too many people using the mentioned applications. People in this group stated that they mostly use e-payment and e-invoice applications.



Graph 12. Which smart applications do you think should be in the building you live in? (Multiple options can be selected.)

People were asked which smart applications should be in the building they live in. When we look at Graph 12, the people surveyed answered that there should be smart applications in the buildings they live in such as solar power, LED, wind power, alternative and renewable energy systems. Today, the energy costs of buildings are quite high. Therefore, 32.94% of the people surveyed stated that central heating and cooling systems should be located in buildings that they live in. This is followed by the need for smart home automation systems, security systems and rainwater collection systems in buildings, respectively, as a ratio. Finally, among the smart applications that should be in the buildings that people live in, other than these, the number of people who gave the answer other is 0.

Finally, people were asked what comes to mind when mentioning about the smart city. Persons surveyed answered this question that the smart city is the cities where there is less human effort, offering better quality and improved living opportunities, the works are carried out with more technological equipment and devices, using renewable energies that can meet its own energy,

which is quieter and cleaner, where the digitalization and the use of digital media are widespread, virtual and technological entertainment and social activities are carried out, where autonomous and electric vehicles are used and there are charging stations for electric vehicles, environmental and smart waste systems, recycling systems, smart management systems, smart health, smart security and smart traffic systems, smart alternative and integrated transportation systems such as bicycles and scooters are there, which have a high level of well-being, where natural resources are used economically and efficiently and innovation approach is adopted, where there are e-municipality and smart city applications, and also there are opportunities related to more education, culture, health and social issues and access to these opportunities is easy, which is disaster resistant and protecting the environment with environmentally friendly technological systems, which have advanced and smart infrastructure systems, where the citizens who are conscious and aware of smart applications and technologies live and the data about the city is obtained through sensors and cameras, in which smart home and all smart city systems are integrated and which are livable, sustainable, resilient and self-sufficient planned cities.

5. Conclusion and Evaluation

As can be seen in the results of the survey conducted with 252 people from different age groups residing in different provinces, there is a lack of knowledge and awareness about smart city applications. For this reason, it will be very useful for local governments to take a leadership role and provide more information so that citizens can use these applications more. Persons participating in the survey have been residing for 10 years or more in their place of residence; they are mostly somewhat satisfied with the smart city applications of the municipalities. In addition, a large majority of the respondents stated that municipalities should assume the leadership role in the management of smart cities. In addition, the respondents stated that they first became aware of smart city applications through friends and by searching the internet from search engines. In addition, 119 out of 252 people surveyed, that is, the vast majority, stated that they do not use and/or do not know e-applications used in their place of residence, on a local scale or in provincial or district municipalities. Finally, people were asked what comes to mind when the concept of smart city is mentioned. At this point, it has been observed that each of the individuals express some specific features related to smart cities. However, when all the given answers are brought together, a more holistic smart city concept is formed and thus the smart city concept gains a healthier integrity of meaning. Therefore, based on all this information, municipalities should be in contact with citizens more actively about smart cities and smart city applications and creating activities to increase knowledge and awareness in which citizens can participate, will be useful in contributing to the development of cities in the coming years.

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