



## A study on smart urbanization research in Mersin Metropolitan Municipality

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Cite this study: Ersin, M. (2021). A study on smart urbanization research in Mersin Metropolitan Municipality. *Advanced Land Management*, 1 (1), 7-15

### Keywords

Smart cities  
Social services  
Public life

### Research Article

Received: 11.10.2021  
Revised: 12.11.2021  
Accepted: 19.11.2021  
Published: 15.12.2021

### Abstract

As a result of globalization, increasing urban populations bring with big problems. Due to population growth in cities, different problems are observed in many areas such as education, infrastructure, transportation, environment, health, energy and security and city municipalities are encouraged to use the latest technology in the world to overcome these problems. The concept of "smart cities", which was emerged in this context, directed municipalities to projects that facilitate city life easier. In this context, the aim of the study is to examine the smart city applications within the scope of Mersin Metropolitan Municipality projects. Firstly, the concept of smart city, national and international literature review on this subject and the applications related to smart city in Mersin were discussed. As a result, it is seen that the necessity and importance of smart city applications are increasing.

## 1. Introduction

Today, human beings live intertwined with technology [1]. As a result of globalization, technology is used in all areas of human life and provides great convenience to people. Advances in technology are rapidly changing urban life and causing transformations [2-3]. Today, cities face many problems as a result of increasing population, from infrastructure, transportation, traffic, air and water pollution, unplanned urbanization. In order to overcome these problems, the city administration seeks various quests and it is aimed to overcome these problems by creating different perspectives. Since the 1990s, city administrations have adopted human-oriented approaches and strategies in order to cope with the problems in cities both in the world and in Turkey [4-5]. The concept of 'smart city' that emerged in this context has become a popular approach to increase the quality of human life. Therefore, projects related to smart city applications have increased and become widespread [6].

In this context, the main purpose of this study is to evaluate the smart city applications of Mersin Metropolitan Municipality by examining the factors that are effective in the concept of smart city within the framework of technological development. This study aims to contribute to existing research in various ways. Firstly, it is to draw attention to the smart city policies and strategies of the city administrations by highlighting the smart city applications of the Mersin Metropolitan administration. Secondly, this paper is to compile the national and international literature on smart city applications.

This paper is organized as follows. In chapter two, the concept of smart city is explained conceptually and the relationship between these smart city elements and technological developments is examined. In the third chapter, the most up-to-date national and international scientific and academic studies on smart cities are presented. In the fourth chapter, information is given about the projects that Mersin Metropolitan Municipality has implemented and planned within the scope of smart city. Conclusions and policy recommendations are given in the fifth section.

**2. The smart city concept: General elements and technologies**

The city is a residential area that emerged with the necessity of people living together. In recent years, it has been one of the driving forces of the growth of cities with population densities. The city, as the place where knowledge is produced, is known as a key region for development. The concept of smart city, which stands out as a remarkable potential in solving urban problems in a rational way, is expressed as learning ability, technological development, new discoveries in information processing, information transfer and technology tools making city life easier. According to another definition, the smart city concept; It can also be defined as a smart combination of donations and activities of independent and conscious citizens in a future-oriented manner in their perceptions of economy, governance, people, mobility, environment and life. The concepts that come to the fore in the definitions of smart cities in the literature are as follows [7].

Resources are used more effectively and smartly,

- Priority is given to cost and energy saving practices,
- Having a high quality of life,
- Less environmental pollution,
- Low carbon emission,
- Public participation rate in decisions about the city

Smart cities are defined as smart environments with embedded information and communication technologies that create interactive spaces that enable virtual applications to be integrated into the physical world [8]. In addition, in recent years, the smart city and the ecological city union have begun to be mentioned together. In addition to these, smart cities; It is the concept of dealing with the biggest problems in our society such as transportation, pollution, sustainability, safety, health and business and overpopulation. Considered smart, these smart cities are built on an intelligent combination of citizens' assets and activities; They are cities with a positive outlook on the future economy, people, governance, mobility, environment and life [9].

In order to reach the smart city position, it is not enough for city governments to use only the latest technology, there are some basic elements for a city to be smart. In general, these elements in the literature; smart economy, effective mobility, smart environment, smart society, smart life and smart governance. Smart city elements are shown in more detail in Table 1 [10].

**Table 1.** Smart City Features and Qualities [11-12]

Smart Economy	Smart Management	Smart Environment
Innovative spirit	Participation in the decision-making process	The attractiveness of natural conditions
Entrepreneurship	Public and social services	Pollution
Smart Economy	Smart Management	Smart Environment
Economic image and brands	Transparent management	Environmental protection
Flexible job market	Political strategy and perspective	Sustainable resource management
Efficiency	Local availability	Cultural facilities
Transformation ability	National-international accessibility	Training facilities
Lifelong learning	Availability of IT infrastructure	Health conditions
Social and ethnic majority	Sustainable innovative and safe transport systems	Individual security
Flexibility		Building quality
Creativity		Tourist attraction
Clearance		Social structure
Participation in public life		

These elements and their features given in Table 1 are smart city components that are globally accepted. The formation of a smart city is also an indication that it does not consist solely of technology. The elements of the smart city in question are the components that should be implemented in the city administrations of both Turkey and all other countries.

Therefore, the projects carried out by the European Union (EU) on smart cities show the importance given to the concept of smart city at the international level. In addition, it supports projects related to smart cities of EU member states and candidate countries. Some of the smart project initiatives taking place in the EU are [11,13].

The Amsterdam Smart City Initiative project underlines the importance of fostering collaboration between the business sector and city dwellers and managers developing smart projects through energy conservation.

- Southampton City Council has switched to smart cards to highlight the importance of e-services.
- Edinburgh City Council has created a smart city vision as part of an action plan for state transformations.

- Malta's Smart City Strategy promotes business park projects, which it sees as leverage for economic development.
  - IBM, Siemens and ORACLE always take their Smart Planet visions one step further.
  - The Smart City INTERREG project was created by developing e-government services in the North Sea region in three dimensions between academia, industry and government stakeholders.
  - As a result of the pilot study in four schools in the north of Portugal, a 12-13-year-old student was asked to describe the curriculum and simulation method. It is seen that 20% more success was achieved in the group in which the simulation method was used.
  - Interpreting services are provided to tourists by placing 3 km long beacons (a location-based interaction technology using Bluetooth technology) in the city of Amsterdam. In this way, crowding in certain places in the city was prevented.
  - Deloitte Amsterdam office generates more electricity than it consumes with 28,000 lighting panels placed on the roof of the building.
  - In Oslo, which implemented smart street lighting for the first time in the world, savings of up to 70% were achieved in street lighting consumption.
- Here are a few examples of smart city project applications made in various parts of the world related to smart city applications [13].
- With the automatic traffic control and tracking system, withholding tax in Los Angeles decreased by 35%, intersection delays by 20%, travel time by 13%, fuel consumption by 12.5% and air emissions by 10%.
  - Tokyo spent \$54 million on water pipes and electronic leak detectors, reducing water loss by 3.7%, earning US\$172.4 million.
  - Israel obtains 85% of its water needs from desalination plants. By 2020, this rate is estimated to be 100%.
  - In Bukchon, a tourist area in Seoul, sensors are placed in garbage cans. In this way, garbage collection activities were carried out more regularly and the number of tourists increased.

## 2.1. Smart City Systems and Solutions of Municipalities

There are 30 metropolitan municipalities and 1,397 municipalities in total in Turkey. The population of metropolitan cities continues to increase over time. The problems that emerged with the increase in population made it necessary to change the understanding of municipality. Municipal administrations are required to carry out smart projects by taking advantage of the latest technological developments in order to eliminate or minimize the problems that occur [14]. In this context, the biggest problems in cities, the problems they cause and smart solutions are summarized in Table 2.

**Table 2.** City Problems and Suggested Smart Solutions [7]

Topics Urban Problems Smart Solution					
Transport	Energy	That	Health	Security	Urban Problems
Traffic jam	Increasing energy demand	Increasing water demand	Decrease in service quality	Increasing crime rates	Unplanned urbanization
Long time in traffic	Expensive, inefficient energy use	Loss of renewableness of resources	Difficulties in service delivery	Intelligent security systems	Elimination of the concept of time and space in services
Harmful gas emissions	Illegal use	Smart meters,	Home care	MOBESE, camera, smart sensors etc.	City information system
Adaptive traffic control	Smart meters,	Water quality monitoring	Environment		City guides
Smart link app	Smart grids	Leak detection	Environmental pollution		Waste management system
Parking guidance systems	Building energy management		Intelligent solid waste collection		Information kiosks
Smart bike			Decrease in service quality		Address and population information system

As can be seen in Table 2, smart solutions taken against the biggest problems in cities facilitate the service delivery of municipal administrations and raise the living standards of the society. In order to provide a better service to their citizens, municipal administrations seem to have agreed with the aforementioned companies for the implementation of smart systems in cities.

### 3. Results

In recent years, smart cities are an issue that has been given importance by the managers of big world cities (New York, London, Tokyo, Dubai etc.). Therefore, it is observed that there are studies on the aspects of smart city applications in studies conducted abroad.

Albino et al., [14] seeks to clarify the meaning of the word “smart” in the context of cities, with an approach based on an in-depth literature review of relevant studies as well as official documents of international studies. It also defines the main dimensions and elements that characterize a smart city. Different measures of urban smartness are reviewed to illustrate the need for a common definition of what constitutes a smart city, its definitions, and how it performs compared to traditional cities. In addition, performance measures and initiatives are described in several smart cities. Chourabi et al., [15], making a city “smart” emerges as a strategy to reduce the problems caused by the increase in the urban population and rapid urbanization. In response to the increasing use of the concept and closing the gap between smart cities in the literature, this article proposes a framework for understanding the concept of smart cities. Based on a search of a large and comprehensive body of literature from various disciplines, it has identified eight critical factors of smart city initiatives. These; management and organization, technology, governance, policy context, people and communities, the economy, built infrastructure and the natural environment. These factors form the basis of an integrative framework that can be used to examine how local governments envision smart city initiatives. The framework proposes directions and agendas for smart city research and sets out practical implications for policy makers.

Caragliu, et al., [12] aims to shed light on the often-difficult definition of the 'smart city' concept. A focused and operational description of this structure is presented and consistent evidence on the geography of smart cities in the EU27 is included in the study. Statistical and graphical analysis makes deep use of the latest version of Urban Audit data, tuned to analyze the factors that determine smart cities performance. As a result, it is concluded that a new strategic agenda for smart cities in Europe is established in order to achieve sustainable urban development and a better urban landscape. Schaffers et al., [16] explores internet cities, an open and user-oriented innovation environment to test and validate internet-enabled services for the future. Based on the current landscape analysis of smart city pilot programs, projects in the field of Future Internet experimental research and Living Labs can identify common resources for research and innovation that can be shared in open innovation environments. Effectively sharing these common resources with the aim of establishing urban and regional innovation ecosystems requires sustainable partnerships and cooperation strategies among key stakeholders.

### 4. Discussion

Many cities in Turkey are striving to become a smart city quickly. With the smart applications of Mersin Metropolitan Municipality, Mersin carries out big projects in line with being a smart city. Detailed information about the projects and projects carried out by Mersin Metropolitan Municipality within the scope of smart city is given below [17].

- **Smart Transportation Systems:** With the smart transportation web portal service, it is aimed to serve the citizens of Mersin through a single portal, and it has also been included in the phone application (Figure 1).
- **Smart Bicycle on Mersin Beach Project:** In addition to the city's infrastructure works, the importance of bicycle lanes and pedestrianization regulations in the transportation of the city is emphasized. The aim of this project, which was carried out within this framework, is to contribute to health, tourism and environmental policies as well as reducing traffic density. With this request, the people of Mersin will be able to use the bike with a credit card or KENTBIS card (Figure 2).
- **Metro Project:** This project, which has been started and continues, is the most important project in smart urbanization and is a vision project that will become a catalyst (Figure 3).
- **VR Mersin Project:** The VR Mersin project, which is one of the projects of the Metropolitan Municipality for the promotion of Mersin, that can be seen on the internet with the 360-degree virtual tour method, includes aerial, land, day and night shots at 272 points throughout the province. With the project, users can access Mersin's historical, natural and cultural values from anywhere in the world on the internet in a fast and reliable way. At the same time, users can watch 272 points on the Mersin border with a 360-degree virtual tour method, like a large open-air museum, while the system has four different language options. Mersin Promotional Film, prepared as part of the project, was selected as the best "TravelByDrone.com" video worldwide in September 2016 (Figure 4).



- **“Teksin Mersin” Smart City Mobile Application:** A vision project where many services that make life easier with the application downloaded to the phones of citizens living in Mersin are provided from a single platform (Figure 5).



Figure 1. Smart Urbanization in Mersin



Figure 2. Smart Urbanization in Mersin (Bicycle)



Figure 3. Smart Urbanization in Mersin (Metro)



Figure 4. Smart Urbanization in Mersin (VR Mersin)

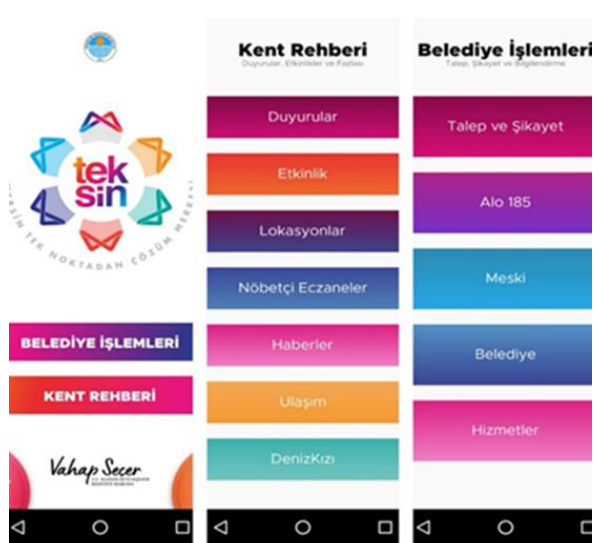


Figure 5. Smart Urbanization in Mersin (Teksin Mersin)



Figure 6. Smart Urbanization in Mersin (Call Center)

- **Mersin Metropolitan 24/7 Call Center:** With the call center system, which is accessible to Mersin Metropolitan Municipality citizens, all requests, suggestions and complaints of Mersin people can be conveyed to

the center 24/7. With the system, requests and problems are answered in a very short time, quality and fast service is provided. Another service of the Metropolitan Municipality is the Whatsapp notification line. Citizens can photograph and send the missing parts of the city to 0533 155 2 153 Whatsapp line. Citizens living in Mersin can now instantly report their requests, complaints and suggestions to the municipal authorities via their mobile phones (Figure 6).

- **Agricultural Forecasting and Early Warning System Project:** With this project aimed at farmers, farmers' products are protected against possible dangers. It is a project in practice with the effect of minimizing the effect of the producer on meteorological damages with the Agricultural Forecasting and Early Warning System, and all farmers are satisfied with this situation. With the project, agricultural risks are estimated and the damage to the producer is minimized with 12 stations established in 8 districts in Mersin. Information on meteorological pests coming from active stations is notified to the producers via SMS (Figure 7).

- **Smart Stations Project:** Mersin Metropolitan Municipality, which uses the developing technology effectively in its projects and services, has implemented the air-conditioned station project in Mersin, where the temperature is above 40 degrees in summer. Air-conditioned smart stations with features such as cameras, air conditioners, libraries, wireless internet, corporate television, uninterrupted energy and technological stops produce their own energy. The air-conditioned station, which produces its energy from the solar panels on it, has a system that provides coolness in the summer, protects the citizens from the outside environment and provides heat energy in the winter. In addition, it offers the opportunity to have a good time by reading a book while waiting for the bus at the bus stop that will stop at the bus stop. Stops of 16.8 m<sup>2</sup> will be recorded 24/7 with a security camera and citizens will be able to receive free Wi-Fi service. Citizens will be able to learn the bus times and the estimated arrival times of the buses with the corporate televisions at the station (Figure 8).



Figure 7. Smart Urbanization in Mersin (Agricultural)



Figure 8. Smart Urbanization in Mersin (Bus station)

- **Managed Wireless Internet:** It is a system that provides free internet service to citizens, thus enabling them to access the internet whenever they need it (Figure 9).
- **Geographic Information System:** A system model has been implemented that ensures that the geographic information systems needed by Mersin are fully met (Figure 10).
- **Mersin Metropolitan Municipality E-Government Project:** It is a major project where software services are provided to citizens in e-government, the state's gateway to the internet, which is Turkey's largest information network. With 7 services opened in a year, it is the second-best metropolitan municipality in inquiry in all fields (Figure 11).

1. E-Receipt Inquiry
2. Documentation Tracking
3. On Duty Pharmacy Inquiry
4. Inquiry Statement Information
5. Inquiry for Registry Information
6. Inquiry for Accrual Information
7. Collection Information Inquiry

- **Career Center Project:** The database that connects job seekers and employers in Mersin with a common database is a very secure and powerful Project (Figure 12).



Figure 9. Smart Urbanization in Mersin (Wireless)

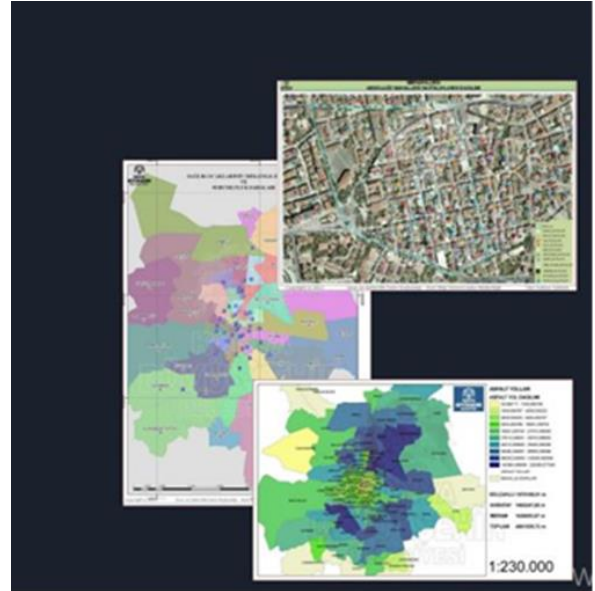


Figure 10. Smart Urbanization in Mersin (GIS)



Figure 11. Smart Urbanization in Mersin (e-government)



Figure 12. Smart Urbanization in Mersin (Career Centre)

- **Disabled Individuals Database Project:** A database of disabled people living within the service boundaries of Mersin was created, their needs were identified and directed to relevant places. With the project, hospitals, schools, rehabilitation centers etc. It is possible to use facilities suitable for disabled people in accessing places. Metropolitan Municipality teams continue to work in the center and in the districts to visit the disabled people in the database and fill in the Disabled Information Form. There are 17,751 disabled individuals in the database (Figure 13).

- **Management Information System:** It is a document automation system with 8 modules. It is a system that enables documents to be prepared in electronic environment, signed and approved. Mersin Metropolitan Municipality is one of the first metropolitan municipalities to use the Management Information System fully (Figure 14).

1. Ebys Module
2. Aykome Module
3. Income Module
4. Analytical Accounting Module
5. Domestic Solid Waste Module
6. Officer Module
7. Movable Goods Module
8. Purchasing Module





**KAYIT DEFTERİ**

**ENGELLİ BİRİY BİLGİLERİ**

KAYIT TARİHİ

T.C. KİMLİK NO

DOĞUM YERİ / TARİHİ

İL/İLÇE

Figure 13. Smart Urbanization in Mersin (Database)



Figure 14. Smart Urbanization in Mersin (Management Information System)

## 5. Conclusion

In 1980, with the industrial revolution, people's desire to live in cities started and this situation gained momentum after the development of technology and the concept of globalization in the 2000s. It is also estimated that the majority of the future population worldwide will live in cities. In order to overcome the problems that arise as a result of the increase in the population in the cities, it has become mandatory for the city administrations and municipalities to establish smart systems in the cities.

When the national and international literature is evaluated, it is seen that smart cities are generally considered as a solution to the problems that arise in cities. In other words, it is obvious that the concept of smart city is a planned city management by making use of technological developments. In other words, for a city to be called a smart city, it must have a structure that can produce smart solutions to problems, smart economy management, smart mobility, smart environment and most importantly, smart citizens use them.

It is seen that Mersin Metropolitan Municipality, which is considered as a case study within the scope of the study, has created quite a lot of projects within the framework of the smart city and put these projects into practice. It can be said that the smart projects produced and planned by the city of Mersin facilitate human life and put the city life in a systematic order. Although smart city applications in Turkey are very limited, it is seen that Mersin Metropolitan Municipality under the management of Vahap SEÇER has made a certain progress and succeeded with the projects it has done, as a result, the lives of people in urban life will be shaped by smart city applications. With smart city applications, solutions to problems and providing user-oriented municipal services are adopted and infrastructures will be created with information and communication technologies. The main suggestion made within the scope of the study is; It is predicted that metropolitan municipalities will give importance to smart city projects and will help cities to develop more quickly.

As a result, the lives of people in urban life will be shaped by smart city applications. With smart city applications, solutions to problems and providing user-oriented municipal services are adopted and infrastructures will be created with information and communication technologies. In this context, the smart city approach is one of the most important breakthroughs in the formation of knowledgeable and cultured cities.

## Conflicts of interest

The authors declare no conflicts of interest.

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