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TURKISH SMART CITIES' LOOK AND OVERVIEW IN TERMS OF SUSTAINABILITY

SÜRDÜRÜLEBİLİRLİK BAĞLAMINDA TÜRKİYE'DE AKILLI ŞEHİRLERİN GÖRÜNÜMÜ VE GENEL BİR DEĞERLENDİRME

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ABSTRACT: On a day with the interruption of the urban functions such as the failure to meet the needs of the citizens as well as the impairment or depletion of limited resources and unplanned urbanization which is caused by the factors including fast growing population, uncontrolled power etc., urban suggestions in different concepts are deliberated within the scope of sustainability.This study aims to evaluate the overall situation across Turkey and the world thereby addressing the smart cities within this concept in terms of sustainability. To this end, determinations have been made based on the data obtained from the literature as well as relevant documentation, sites and visits of the relevant units.The study demonstrates that they are in the organization process and that similar and/or several projects have been implemented considering relevant documentation in line with the requirements of each city across our country as well as across the world. Nevertheless, in Turkey, in particular, it has been found necessary to start from the correct sports in smart urbanization, further expand organization and materially support local administrations. Another significant matter is that it is necessary to focus on making local people, one of the key elements of smart city, achieve public awareness at this point with industry 4.0.

Keywords: Sustainability, Sustainable Development, Smart City, Smart Urban, Society 5.0, Local Administrations.

ÖZ: Hızla artan nüfus, kontrolsüz göç vd. etmenler neticesinde ortaya çıkan çarpık kentleşme süreci ile sınırlı kaynakların zarar görmesi ya da tükenmesi ve/veya karşılaşılan çevre sorunlarının yanı sıra vatandaşların ihtiyaçlarının karşılanamaması gibi kentin işlevlerinin sekteye uğraması sorunu ile yüzleşilen günümüzde bunun çözümü için sürdürülebilirlik kapsamında farklı konseptte kent önerileri tartışılmaktadır.Bu çalışma sürdürülebilirlik bağlamında bu konseptlerden biri olan akıllı şehirleri ele alarak dünyadan ve Türkiye'den örneklerle gelinen genel durumu değerlendirmeyi amaçlamaktadır. Bunun için literatürün yanı sıra, ilgili belgeler, ilgili birimlerin sitelerinden ve ziyaret neticesinde elde edilen veriler ele alınarak tespitlerde bulunulmuştur.Çalışma sonucunda dünyada olduğu kadar ülkemizde de her şehrin kendi ihtiyaçları doğrultusunda ve ilgili belgeleri de göz önünde bulundurarak örgütlenme sürecinde oldukları, benzer ve/veya farklı projeler gerçekleştirdikleri görülmüştür. Yine de özellikle ülkemizde akıllı şehirleşmede doğru noktalardan başlaması, örgütlenmenin daha da genişletilmesi ve yerel yönetimlerin maddi olarak desteklenmesi gerekliliği yönünde tespitlerde bulunulmuştur. Bir diğer önemli husus ise endüstri 4.0'la birlikte gelinen bu noktada akıllı şehrin temel unsurlarından olan yerel halkın da akıllı toplum bilincine ulaşabilmesinin üzerinde durulması gerekliliğidir.

Anahtar Kelimeler : ***Sürdürülebilirlik, Sürdürülebilir Kalkınma, Akıllı Şehir, Akıllı Kent, Toplum 5.0, Yerel Yönetimler.***

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1. INTRODUCTION

Issues such as rural migration and fast growing population negatively influence economic and social life and quality of life. On the other hand, urban people desire to live urban welfare in a sustainable manner. Besides that, upon advancement in technology, cities have both increased connection with each other at a global level and started to share the concerns debated under the concept of sustainability. It is believed that the solution methods will function indissolubly by applying the methods developed for these connections and shared concerns at urban level.

Solution suggestions in different concepts appeared for this target through this process along with the concept of sustainability considering today's needs and the needs of generations to come and environmental effects. The concept of city, which has been characterized under sustainable city, smart city, resistant city, slow city, ecological cities and other names, has been a level on which methods are used as concepts which are both common and different from each other. That is why urbanization has become a significant means of consumption and a significant means of sustainable development and there has been a redesign of this means. Climatic change and environmental problems have drawn attention and studies and advancements in technologies enabled building the concept of "Smart Cities" and several suggestions for solution brought about along with this concept.

This study aims to have an overall evaluation of the city that is shaped within the context of sustainability and illustrate the concept of smart urban, which is one of the ways suggested for that.

While doing this, the study also mentions some Turkish metropolitan cities along with the examples from the world and makes some points by the help of the literature.

2. CONCEPTUAL FRAMEWORK

It would be useful to briefly address some concepts while discussing smart city within the context of sustainability:

2.1. Urban / City

There are several literature definitions of a city/urban in several conditions, several perspectives and several interpretations in terms of its use by researchers.

For example, David Harvey (2009) says "Urban is undoubtedly a complicated thing. Part of the challenges depends on its specific complication." The Wise Architect, Turgut Cansever says: "What is a city? Is it a physical phenomenon? An economic incident? A social and cultural incident? All of them, indeed. What is the determining and prior element in a city which involves all of them? Actually, each member of a profession says 'I am the most important one'. Builders says 'Our work builds cities'. An economist says 'it is economy what determines everything'. And a sociologist would push social life to the forefront.

Louis Wirth (1897-1952), on the other hand, states that a city is characterized by three qualities, which are population size, intensity, heterogeneity. Wirth also says that non-urban life styles can be observed it cities and urban life styles can be observed outside cities. Wirth asserts that urban and rural lives have particularly converged upon the advancements in transportation and means of communication (Keleş, 1993).

After all, a city is certainly associated with accommodation, commerce, education. While a substantial majority of people choose their city based on their job or education, a city is also associated with history, culture, design and aesthetics. Indeed, a city is a place which gives the sense of living.

Finally, if we focus on two other points in relation to the concept of city (or rather its administration); Kürşat Bumin says there are several aspects of a city. We can approach a city through psychoanalysis concepts, a ruler and a compass, through novels and poetry, military concerns, "nostalgia", "progress and order", through "class struggle" (…) and certainly through its relationship with democracy. Therefore, an urban is the common subject of several disciplines including sociology, economy, "art of war" and architecture. Nevertheless, above all these disciplines, one should immediately assert that an urban is the main subject of the urbanized, those living there. The urbanized should constantly question urban life by means of the concepts produced by all disciplines, and they should constantly bring new values. It is also their responsibility to build, organize, and restore

the city along with the specialists in the relevant fields. It would not be 'populism' to say that the decision makers of the cities are not the specialists but the urbanized, and such a definition of a city actually emphasizes the involvement of people and democracy (Bumin, 2013).

2.2. Sustainability

Sustainability is maintaining a condition or a process without limiting it with a certain time. (Yavuz, 2010, p. 63). Based on the report published by the World Commission on Environment and Development in 1987, sustainability was described as "meeting today's requirements and expectations without sacrificing meeting the requirements and expectations of the generations to come" (WCED, 1987, p. 16). This concept is made of three elements including social, economic and environmental sustainability (Tuğdemir et. al., 2016, p. 342). If sustainability is intended, environment, society and economy should be worked on as a whole (Özmehmet, 2008, p. 1855).

Therefore, according to Bruntland's Report, sustainable development is "a development meeting today's needs without sacrificing the meeting the needs of the generations to come". Accordingly, sustainable city can be referred to as the locations with a system that tries to reduce the consumption of the natural resources and make them renewable while realizing social and economical development; that can respond to the needs of urban people and transfer them to the generations to come (Işıldar, 2012, p. 28).

We can explain what sustainable urbanization intends as follows: Increase quality of life, regulate population growth, audit urban growth, slow down cities' outer expansion, adopt approaches that are in compliance with local qualities and values at the stage of urban planning, develop strategies for poverty, eliminate unemployment and nutrition problems, protect and improve biodiversity, rearrange technological infrastructure, use of renewable energy resources, use of clean water and treatment of polluted water (Karakurt Tosun, 2013).

Along with sustainability, city concepts with both common and different concerns have been asserted, namely smart city, slow city, and resistant city.

2.3. Industry 4.0

Making smart products a part of human life, Industry 4.0 started and it was characterized as "Digital revolution", fourth generation of industrial revolution or the fourth industrial revolution. Smart phones, smart homes and other smart products further brought us to smart city applications. Having been uttered for the first time during a fair in Germany, the first key components of industry 4.0 are "new generation software and hardware", that is, hardware that occupies less space with less cost, consumes less energy, produces less heat, and has higher safety. The second component, which is farther significant is the "Device Based Internet", that is, internet based smart electronic systems that are equipped with sensors and processors where all existing devices are integrated to each other in a data flow, which are also called "cyber-physical systems" (www.hurriyet.com.tr, 16.04.2018, access 06.09.2019).

We can summarize the process and key dynamics of the industrial revolutions with their reflections on both private and public sectors as follows:

Table 1. Key Dynamics of The Industrial Revolutions in Terms of Private Sector and Public Sector

Industrial Revolutions	Private Sector	Public Sector
First Industrial Revolution	18th century, Steam Power, Capitalism Machine Invention, Diffusion of machine production, Capital Saving Processes, Factories, Labor, Markets emerging, Need for raw material and competition	18th century, Capitalism, Urban territories' formation, Division of labor, Specialization, Hierarchy, Centralization, Bureaucracy, Urban and Local administrations' formation, Nation-state, Public Service, Infrastructure, housing, health, unemployment, education
Second Industrial Revolution	19th-20th century, Manufacturing 2.0, Electric energy, Intense mechanization, Assembly line, Fordism, Mass Production, Domestic (national) Market, Scientific Management	20th century, Welfare State, Keynesian Policies, Minimum income, Social Security policies, Social security, Retirement, Health coverage, Equal and qualified public services, Social services,
Third Industrial Revolution	1970s, Computer technologies, Programming without human interference, Robotics, Computerization systems, Electric energy,	1970-2000, Transformation in Keynesian Welfare state applications, Neo-liberalism emerging, Transformation in public and social services, Globalization in agendum, Transition from national market to global market relations, Disruption of public expenditures, Privatization, Downsizing of the state, Liberalization of labor market, Transfer of public services to private sector, Indigenization
Fourth Industrial Revolution (Industry 4.0)	21st century and further, Digitalization, Technology, Smart Factory, Flexible Production, Tailored production, Mental capacity, Big data analysis, Computer technologies, Smart robots, Software, Additive manufacturing, Internet of things, Cloud technologies, Cyber security, Digital platforms, Quantum, Wearable technology, Digital electric devices, Digital media, Virtual works, Digitalization in production techniques	21st century and further, Neo-liberalism, Public-Private affiliations, Flexible work regime, Privatization, Build operate transfer models, Automation and digitalization in public services, Transparency, Accountability, Sustainability, Indigenization, R&D and promotion

Resource: Tetik Demirhan, 2021, p. 151-152.

There are also studies carrying developments beyond Industry 4.0. In general terms, industry is expected to bring added value to societies and communities and whole humanity, and these studies are about the transition to Industry 5.0 considering a socially covering, environmentalist economic framework which is functioning in accordance with sustainable development particularly following Covid-19 Pandemic.

There are researchers who appear to promote the explanations of the European Union, Industrial surroundings, employers' organizations, World Trade Center, the USA and UK business world, Davos Summit and Japanese Business Federation. While these developments influence

production decisions and production processes of the industry, they also encourage further R&D, technological advancement and innovation, investment and financial resource allocation. According to these researchers, a human, social and environmentalist transformation marks transition from Industry 4.0 to Industry 5.0. Accordingly, the transition to Industry 5.0 is referred to as a consequence of the marriage or corporal merging of Industry 4.0 and Society 5.0, and the newly born child is called Industry 5.0 (Büyükuslu, 2021, p. 29-30).

2.4. Geographical Information Systems (CBS)

It is an information system that combines the areas of usage such as collecting, storing, analyzing, presenting "geographical information systems" to users with its roots in the science of geography. It creates location based analyses and information layers by CBS and provides visualization in the maps and 3D locations. Thus, it provides a deeper perspective to the user thereby making inter-data modeling and establishing relationships so that users can decide more smartly.

There are infrastructural insufficiencies in our country and a hybrid approach consisting of "top to bottom" and "bottom to top" policies is applied within the scope of Information Society Strategy for the transformation to smart cities. Accordingly, it is intended to provide guiding documentation and sample studies on smart cities with the action of the "42nd Smart Cities Program Development" under the responsibility of the Ministry of Environment and Urban Planning (and Climatic Change); and it is also intended to promote the local solutions given for smart cities with the action of the "43RD Smart Applications Promotion" under the responsibility of the Ministry of Development by means of the development agencies. This way, while local administrations are directed through central means for the transportation to smart cities, it is also intended to create economic and social benefit through creativeness in local sense (Elvan, 2017, p.9).

3. SMART CITY AND ITS COMPONENTS

A city has become the place of almost all human actions. Cities were previously places of gathering where basic needs were met; and they have become the places which civilize, domesticate, and politicize themselves (Keleş, 2014, p. 10). Transforming humanity, cities have also entered into a process of transformation depending on their growing functions. Transforming in different concepts such as sustainable city, ecological city, metropolitan city, and global city, smart developing city approach through the influence of information and communication technologies have become one further transformation experienced by the cities. Smart cities have a significant mission to form more affordable, more ecological, more accessible, more digital and safer cities; that is more sustainable cities. Smart city concept is also included in the literature with different conceptualizations such as technological city, digital city, information city, creative city, learning city (Nam and Pardo, 2011). Furthermore, there are others who differentiate these concepts from smart city. The reason why smart city concept appears more often in the literature is because it involves user perspective and it is user friendly (Klein and Kaefer, 2008), it has the capacity to renew itself (Marsa-Maestre et. al, 2008), it is more integrable to strategic plans and policies (Center on Governance, 2003).

Another reason why there are no conventional definitions for a smart city is because smart city approach is considered not only a concept but also an information infrastructure and application system for a city (McFedries, 2014). Thus, it is fed by several disciplines and perspectives. In their research where they addressed the problem of defining smart cities, Nam and Pardo (2011,p. 284) rounds up and evaluates definitions from different perspectives. The study shows that smart city concepts have definitions such as being an initiative for the solution of urban crises (Washburn et. al., 2010), integrating a technology in which the city can track itself and find solutions (Hall, 2000), establishing connection between anything that is abstract or concrete in the city (Harrison et. al., 2010), giving place to architecture and personal creativeness as a location (Rios, 2008) and creating opportunities in participation and harmony. As it can be understood from the definitions shared, smart cities are interpreted in different ways thereby centering the specialization of each area. As stated by Nam and Pardo (2011, p. 288), a socio-technical perspective that combines technological and social factors would allow us to definitely define a smart city. Although socio-technical perspective was

associated with the concept of sustainability for long years, the local evaluation of the global influence of the problems and solutions produced by a city resulted in producing more detailed policy documentation and action plans. One of these action plans is the 2022-2023 National Smart Cities Strategy and Action Plan, which was published by the Ministry of Environment and Urban Planning in 2019.

Another reason why the concept of a smart city does not have a global definition is because countries do have their specific qualities, expectations from a smart city and priorities etc. Some of them are as follows (Turkish Informatics Foundation, www.sehirsizin.com, 2016, access 30/08/2017, p. 25):

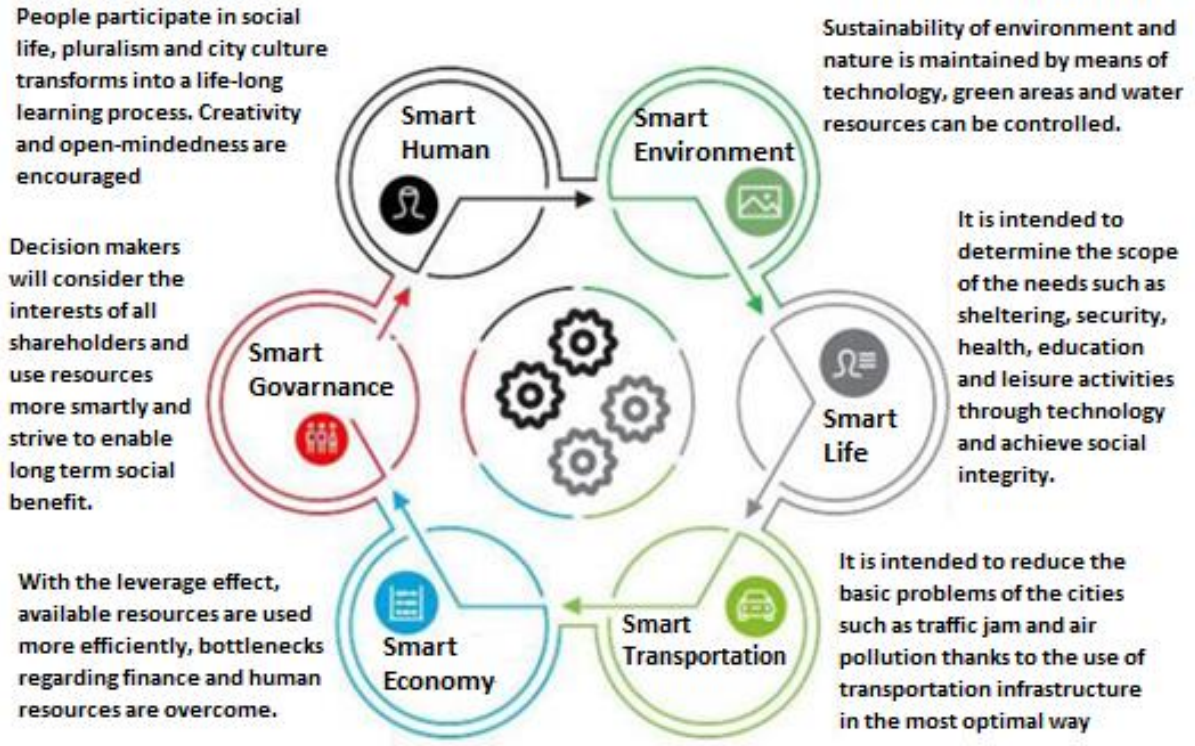
According to UK's Ministry of Renovation and Skills Policies, it will be possible to create more habitable, resistant cities which allow easier struggles against new challenges when public and private sectors get involved in services.

According to the definition of the US Scientific and Technical Information Office, smart cities are "cities where all critical infrastructural conditions of the city including roads, bridges, tunnels, rail systems, airports, ports, communication networks, water and energy resources and major buildings are tracked and integrally managed, use of resource is optimized, protective measures are planned, security factors are followed and citizens are served at the highest level."

International Standards Organization (ISO) defines smart city as "A new concept and a new model where new generation information communication technologies such as internet of things, cloud computing, big data and integrated geographical information systems are applied to facilitate urban planning, administration, building and smart services." (Turkish Informatics Foundation, www.sehirsizin.com, 2016, access 30.08.2017, p. 25).

According to the methodology of Boyd Cahen's "Smart Cities Wheel (SCW)" approach which is accepted by the European Union in the planning of the process of transformation into smart cities and tracking the applications, "Smart Cities" consist of six key components, which are smart environment, smart administration, smart economy, smart life, smart society and smart transportation (Turkish Informatics Foundation, www.sehirsizin.com, 2016, access 30.08.2017, p. 12).

Figure 1. Smart City Components



Resource: Turkish Informatics Foundation, www.sehirsizin.com, 2016, access 30/08/2017, p. 12

As is seen from the figure, each component of a smart city is in conformity with those expected from the previously stated sustainable cities and other urban concepts.

The "smart" concept in the expression "smart city" has been criticized since its first day; therefore, several researches have been made for the inclusivity of the meaning of this concept. This is also another reason why the concept of smart city has many definitions and this promotes diversity and the improvement in every substructure today.

While examining the definitions of smart cities, it is important to note technological advancement, people's participation and all other shareholders' involvement in the process, non-breach of ethical rules such as personal data privacy, and self-improving and sustainable application. Within this scope, smart cities are referred to as the safe, reliable, predictable, environmentalist and efficient urban centers of the future, which are equipped with several sensors, electronic devices and advanced technology like networks (Turkish Informatics Foundation, www.sehirsizin.com, 2016, access 30/08/2017).

In terms of urbanization, smart cities involve quality of life, increasing efficiency in urban systems, particularly transportation and energy; increasing quality in living quarters, for example reducing air pollution and noise pollution, etc., improving services, increasing competitive powers of the cities (Yılmaz, 2015, p. 7).

The benefits of smart cities could be listed as financial, urban life, brand and competitive power and those will lead to advantages in perception. (Turkish Ministry of Development, 2013, p. 29-34):

As a financial benefit, we can list "reducing capital expenses" to further benefit from capacity and assets; "reducing operating expenses" to give importance to real time data by protective maintenance instead of repair through less use of service teams; "increasing incomes" which refers to price mechanisms (i.e. public transportation, smart park meters) or demand management tools (i.e. traffic jam billing) to optimize use and increase consumption by increasing quality of service in some solutions.

As urban life benefits, we can list higher quality of life for the citizens and those benefits can vary based on the ways of solution produced depending on the problems of that city. For example, reducing time of transportation, high security, accelerating emergency care, etc.

As the benefits for brand and urban competitive power, we can list job opportunities that come from the concept of "smart", strengthening funding sources, urban human resources and their contribution to economy. Therefore, this brand related condition could lead to employment and job opportunities for more qualified individuals and competition. We should consider some requirements of this technology in order to obtain those benefits and realize smart city application. For example, tough, reliable technology and its compatibility with the existing technical platform are the important matters to be taken into consideration. Attention should be paid to technological purchases in the cities (such as security, speed of change in technology. On the other hand, technology providers should pay attention to durability and safety standards in order to be accepted by public institutions and local administration.

In our country, the fast increase in the urban population led to the debate on the necessity of applying smart cities. According to the Smart City Road Map Report, which was made as a result of the researches made in the global and local platforms along with the contribution of 23 Municipalities in Turkey, it was predicted to "contribute nearly 30 billion Turkish Liras per year to the Turkish Gross Domestic Product through with city programs are designed and integrally applied in the country" and the goal was to have "30 metropolitan municipalities become smart cities" at the first step. The President of Marmara Municipalities Union and the Mayor of Bursa, Recep Altepe mentioned the need for smart cities in the local administrations in the digitalizing world: (www.medyamerkezi.vodafone.com.tr, 28.08.2017):

"Smart digital technologies are considered the key for sustainable lives in the cities. These technologies let municipal services become more efficient by less cost. As local administrations, we need to proceed to smart urbanization. Having a population of nearly 3 million, Bursa is among the leading cities of Turkey in the field of smart urbanization. We have been realizing smart city solutions

that will facilitate and accelerate the lives of our citizens. (…) We promote Smart City Road Map, too. We think this report will have a significant role in making smart urbanization widespread in Turkey".

5 components have been shared within the scope of smart city administration in line with the National Smart Cities Strategies and Action Plan: Governance, strategy management, policy management, integral service management and business management. In addition to those five components, the document also includes 16 applications: Smart environment, smart safety, smart human, smart structures, smart economy, smart location management, smart health, smart governance, information technologies, smart transportation, smart energy, communication technologies, information safety, smart infrastructure, disasters and emergency management, geography information systems. The document covers a national scale action plan and this indicates that the area of application is kept large. Size/number of components/clusters/indicators is more restrictedly scrutinized in the international literature.

For example, if we consider European Parliament's smart city definition, we see a specific emphasis on local managements and a more limited explanation when compared to 2023 National Smart Cities Strategy and Action Plan. European Parliament's smart city is referred to as "a city which desires to address public issues by means of information and communication based technologies in a multi-shareholder, municipality based affiliation" (European Parliament, 2014, p. 9). European Parliament's smart city approach can be listed with the aspects of smart economy, smart transportation, smart environment, smart people, smart life and smart governance. While those aspects can be seen in several academic studies in Europe, there are other studies which have higher or lower number of aspects in this regard.

Bakıcı et. al. (2012) focuses on the aspects of smart city over Barcelona under the titles of smart governance, smart economy, smart life and smart human. While Giffinger et. al. (2007), Albino et. al. (2015) and Zubizarreta et. al. (2016) addresses the same aspects with the European Parliament; Chourabi et al. (2012) describes smart city in 8 aspects: management and organization, technology, governance, policy, human and society, economy, infrastructure and natural environment. Kasznar et. al. (2021) utters 10 themes under corporate, technology and society aspects. These themes are energy, security, transportation, smart city network architecture, health, structure, land use, hydrology, government and population.

4. SUSTAINABLE DEVELOPMENT AND SMART CITY CONNECTION

The progress of information and communication technologies influence and shape the transformations of the cities. The sustainability, renewability, efficiency of the human being and the environment the human being is living in do have a significant place in this transformation. Therefore, Smart cities intend not only efficient and effective resources and higher environmental conscience but also an innovative and human focused living space with health, security, comfort, etc. at necessary levels where urban problems are resolved smartly. Indeed, this should be made in accordance with the specific needs and patter of the respective city (Bulut, 2003, p. 338).

European Commission smart city is a concept "shaped and defined by the factors of economical growth and life quality. In this definition, it is emphasized that goals of a smart city can be provided by means of physical infrastructure, human and social capital, information and communication technology infrastructures." (Turkish Informatics Foundation, www.sehirsizin.com, 2016, access 30/08/2017, p. 25). Moss and Litow, on the other hand, defined smart cities as the systems which increase efficiency in the city, save energy and increase air and water quality through their advanced physical infrastructure, available ways of access and transportation, quickly identify urban problems and assert reasonable ways of solution and share information with the shareholders in the city (Moss and Litow, 2009, p.3), in 2023 National Smart Cities Strategy and Action Plan (2019, p. 20); smart cities are referred to as "more habitable and sustainable cities which are implemented through cooperation between shareholders, use new technologies and innovative approaches, are justified by data and specialization and predict future problems and needs and produce solutions that add value to lives" to specify smart city approach along with its relationship with sustainability and habitability.

As in all urban concepts, sustainability and smartness concept also involves the most important point and connection, the citizens/human beings or citizens/society as covered by the urbanized system. This is because human being and the society are the most fundamental elements to realize those concepts in the cities. Sustainably designed societies have living quarters with hybrid application, which can be used for multiple tasks including sheltering, commerce, education, food production etc. in an accessible framework (Coyle, 2011, p. 3). The process of forming sustainable societies requires designing a new ecosystem in relation to human habitation (Roseland, 2012, p. 20). Sustainable societies are phenomena which are active in the formation of Agendum 21. Social groups which are characterized as sustainable societies strive to have balance and harmony between the artificial environment and nature. The life styles of these groups have inspired sustainable areas of management with sustainable development (Bostancı and Albayrak, 2017, p.231).

It has been asserted above that the concept of sustainability consists of three key elements. Being one of these elements, environmental sustainability is existing ecosystem's adapting into changes in temperature and natural phenomena (Özçağ and Hotunluoğlu, 2015, p. 231). In economic sustainability, on the other hand, while there is an effort to have increase in the goods and services, which are deemed necessary to increase social welfare, the rational use of limited resources is of significance (Sabegh et. al., 2016, p.982). Social sustainability is making society compatible with applications thereby being involved in the process through governance.

If we address the concept of smart city over the same elements, first of all we can mention "high intellectual or human capital" which promotes innovation and which is required to overcome problems or challenges. Secondly, a good quality of life and economic development as an objective and thirdly lifelong learning, use of natural resources with caution and involvement of the citizens in the improvement through a sustainable urban development with a general perspective (Ojo et. al, 2016, p. 30). Here, these three qualities show that transformation, renovation, producing solutions, and therefore adaptation and their sustainability match up with those three dimensions.

While cities increasingly grow in demographics, economics and scale, it gradually becomes challenging to maintain their habitable and sustainable qualities. As an alternative to public policy, the choice of doing nothing (Dye, 1987) is not a good alternative for the cities which form the lives of millions of people, and it is projected that one of the best alternatives to set forth the most suitable solution for the problems of the cities and make the cities sustainable is making them smart. However, it is not sufficient to have information communication technologies in the cities to make the cities gain the title of a smart city (Caragliu et. al., 2011, p. 67). All elements regarding a smart city should be handled in an integral and planned manner.

5. EXAMPLES OF SMART CITIES FROM THE WORLD AND FROM TURKEY

To mention some examples of smart cities with different criteria in the world, they are as follows:

Copenhagen prioritizes investments on sustainability so as to become one of the smart cities in Europe. Being called the green European capital, Copenhagen is known with its ecological side in that it has higher number of bicycles than the number of automobiles and that is a substantial part of its culture. Besides, it appears in higher ranking in the climatic change success index with its investments and applications to reduce carbon release to zero level until 2025. It has electrical public transportation, 100 thousand trees planting goal. They have the strictest safety tests in the world in terms of clean domestic tap water. Copenhagen has wind farm investments and education investments. Upon the analysis of smart city components, we can list the following: Giving importance to shareholders' involvement in all processes in terms of smart human, 75% of citizens actively using smart phones; regaining time spent inside the car in terms of smart transportation; being ranked at the top in the green city index in 2009 in terms of smart life; having smart cities' strategies and applications shaped by a Committee which is made up of several units in terms of smart management; common projects promoting different elements in terms of governance, having solution centers; success in carbon footprint and high level of use of bicycles already mentioned in terms of smart

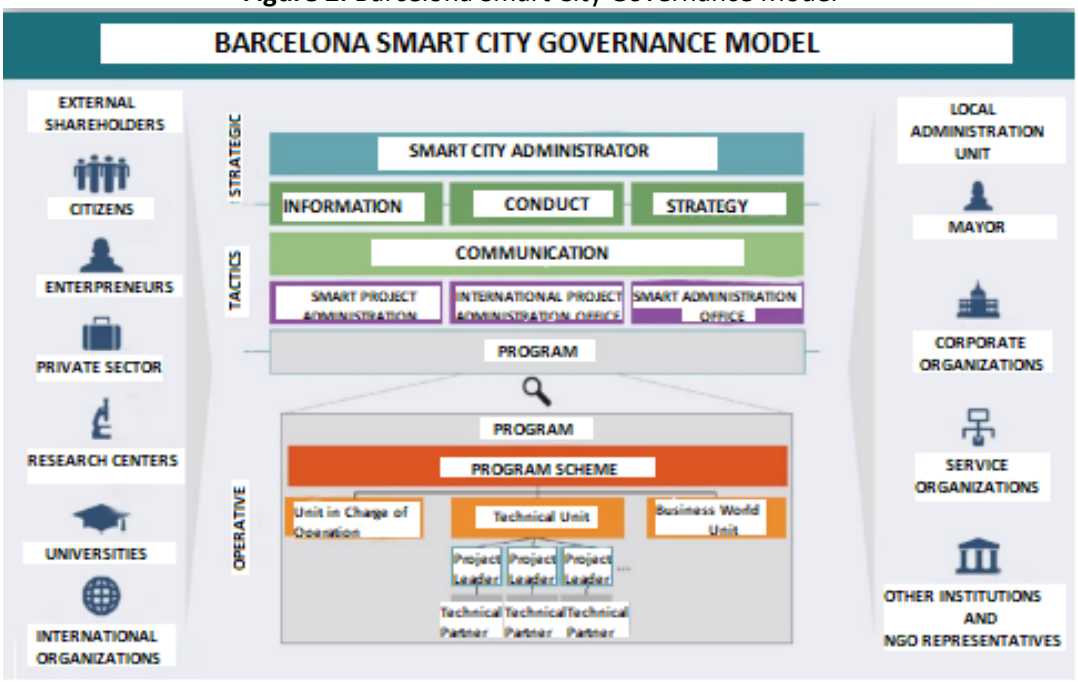
environment; saving in fuel and water consumption through policies in terms of smart economy (www.cevreciyiz.com, 2019; Armağan, 2018, p. 118).

The most innovative and attention grabbing project to make Amsterdam, a smart city is a project which involves the studies of increasing network management and connectivity through smart phones and tablets being executed in relation to Amsterdam Arena Stadium (https://digitalage.com.tr, https://magg4.com/, access 06.09.2019).

Here, indeed, the bicycles are common in the majority of the population, which is suitable to become a sustainable and smart city. Local farming and urban organic nutrition are promoted through the projects. The education system involves ecological awareness. Clothes and fashion also focus on environment friendly materials. They pay great attention to preventing poisonous substances or substances that might lead to water pollution. Its architecture is also shaped in accordance with sustainability in ecological terms. Upon the analysis of smart city components, we can list the following: Comfortable life for old people and patients at their own home rather than hospitals or care centers by means of technology for smart human; real time tracking drivers and green fleet application for driver performance, online info on parking lots, taxi stops, traffic for smart transportation; project on environmental protection from energy to garbage containers as a measure for climatic change in terms of sustainability for smart life; projects on reducing CO2 release and protecting natural resources for smart environment; projects for energy saving and warning citizens through the data for smart economy (www.cevreciyiz.com, 2019; Armağan, 2018, p. 114).

Barcelona strives to become a smart city with its works on lower carbon consumption. Solar thermal energy consumption regulations were published for the first time in the world. And, a laboratory agreement was signed for a wide scale smart city innovation. There is also a "Smart City Governance Model" adapted by Barcelona (Örselli and Dinçer, 2019, p. 102):

Figure 2. Barcelona Smart City Governance Model



Resource: Örselli and Dinçer, 2019, p. 102

In Japan, there are smart city projects which develop measures thereby voluntarily collecting the health info of the elder population voluntarily through smart watches so as to revive and recycle abandoned cities for both sustainability and smart urbanization. Several projects are being implemented at every stage of the process including energy and health in the society. Indeed, each country and each city has their specific projects based on their specific needs. For example, Tokyo stands out with the smart solutions designed for its suburban areas. It has been designing solar energy panels for houses, storage units and smart applications connected to electrical network in cooperation with Panasonic, Accenture and Tokyo Gas companies; smart mobile applications are another example to specify (https://digitalage.com.tr, https://magg4.com/, access 06.09.2019).

In Malta, measurement devices are used to minimize the amount of water and energy consumption along with the changes in smart infrastructure. London stands out with its investments on sustainability. For example, traffic jam data. Moreover, it signed an agreement with O2, Telecom operator for the installation of the largest wireless network in Europe. Hong Kong has studies on infrastructure such as smart road finding service, learning traffic situation with its intense population. San Francisco has smart street maps; Chicago has power production plants added to the buildings for energy saving; Santa Cruz has been working on developing a smart network to check police records at any time. Toronto is shown as the smartest city of the North America with its works on encouraging low carbon use. As an example, we can mention garbage vans operated by natural gas and the use of garbage taken from garbage collection site of the city. Vienna stands out with "Vienna Smart City Vision 2050", "Road Map 2020" and "Action Plan 2012-2015". Furthermore, architects in Vienna act as shareholders and are in cooperation with the municipality in reducing carbon consumption in buildings, urban planning and facilitating transportation (https://digitalage.com.tr, https://magg4.com/, access 06.09.2019).

Within the scope of smart city, Izmir was given the best project prize for its environmentalist and disabled-friendly "Smart Traffic System" project in Amsterdam Intertraffic Fair in 2016. Several technologies and mobile applications are used in several areas from traffic to security, and parking lots for smart life. E-municipality applications provide coordination for transportation and infrastructure services where citizens can easily file reports and submit requests and they are informed if their reports and requests are forwarded to the relevant places if submitted to the wrong units (Tuğaç, 2019, p. 1009; Armağan, 2018, p. 124).

In Istanbul, there is Smart City Project Office within the scope of "Smart City Project Counseling Service Procurement". There are smart applications for traffic, vehicles just like Izmir. There is the first and licensed R&D center in the field of smart transportation systems in Turkey. An IoT based cloud traffic management system was created for the first time in Turkey in cooperation with the Municipality of Istanbul (www.sabah.com.tr, 2017, access 10.01.2022). They are sending SMS to the citizens to inform them about the projects thereby determining their personal characteristics. Tourists are also given cultural and historical information. Another application that stands out for smart life is the lifts for the disabled. We can mention R&D center and IoT system to state smart management and smart transportation. For Smart Economy, they should strive to perform technological and industrial developments in an optimal manner and promote appropriate use of resources and sustainability through waste management. However, the use of illegal electricity should be prevented (Turkish Informatics Foundation, www.sehirsizin.com, 2016, access 30.08.2017).

In Ankara, there are several projects such as smart junctions, smart structure in new buildings, transformation of old buildings accordingly and energy saving projects etc. Turkey also includes smart city systems in several cities. However, if other elements are ignored and smart city is emphasized only through its technology, this might turn into a technology exhibition rather than a smart city. This is also a risk against the sustainability approach (Varol, 2017).

In addition to three major cities in Turkey, another example of a metropolitan city is the Municipality of Kayseri which involves ongoing works in line with all of the abovementioned components in accordance with 2018 Smart Urbanization Report and pilot applications are continued. These applications are listed and detailed in the report as: city air quality tracking stations, smart parking lots, smart lightening, smart stop, shared bicycles, mobile application of the municipality of Kayseri, touristic cameras, door number with QR codes, free wireless internet (Wi-Fi), electric buses, energy management from solid waste, smart irrigation, traffic control centers, smart junctions, SCADA (supervisory control and data acquisition), autonomous (unmanned) public transportation vehicles, smart libraries, smart management-call centers-management-information system (MIS). Although they are in pilot application form in general, it is understood that the works of the municipality is intensely continued. Moreover, non-governmental organizations and universities are also invited to workshop. Further workshop calls could be announced through the website or via email. Smart city works are intensely improved online. The citizens should internalize those applications (Municipality of Kayseri, 2018).

Analyses show that there are also encouraging, guiding and comprehensive documents at the national level for smart cities in Turkey. Long term development plans and short term annual programs are positive for setting goals and policies about smart cities. The 4th strategy and 3rd action plan prepared in the national level in the smart city transformation of 2020-2023 National Smart Cities Strategy and Action Plan also mark those (TUBİTAK BİLGEM, 2021). Furthermore, when we analyze urbanization, transportation, struggle with climatic change, economic development programs, we see that there are plans involving smart applications for those, and they encourage local administrations to adapt the sense of smart city. National documents also have the local emphasis on producing smart applications.

Annual Presidency programs also involve smart cities and there is "National Smart Cities Strategy and Action Plan", which is published biyearly as a medium-term program; "Smart Export Platform" and development plans are of importance in smart cities and they should be of importance in local managements, too. Other action plans and documents also consider smart cities and encourage practices within this scope. When we look at the internal organizations of the metropolitan municipalities, the directorates under "Data Processing Departments" usually focus on this aspect, however, we see the Metropolitan Municipality of Bursa with a separate department, the "Department of Smart Urbanization and Innovation", which directly focuses on the aspect. Some other metropolitan municipalities have such departments under the names such as "Department of Map and Geographical Information Systems", "Department of Strategy Development", "Department of Economic Development, R&D and Innovation", "Department of Reconstruction and Urbanization". Smart city is defined within the scope of the requirements of the respective city. If we address the strategic plans of the metropolitan municipalities, we can say that there are several technological projects designed and implemented within the scope of "smartness". However, we can assert that they rather focus on technological and/or digital transportation regulations within the scope of smart mobility component. Other smart city components (smart environment, smart human, smart economy, and smart governance) appear to be addressed much less than smart mobility component.

Likewise, based on the information obtained from these studies, we can talk about a guiding formation as a result of the analyses made for the organizations in the national and local scale: Local Administrations Policies Committee. One of the duties of this organization is 'to make research on smart urbanization and give strategy recommendations. There are office presidencies, corporate and branch presidencies in the metropolitan municipalities. However, this percentage is 20%. That is 1 out 5 municipalities have been organized for smart cities. When we consider the strategic plans of the metropolitan municipalities in the study, we see that the goals and plans for smart cities involve transportation, traffic, parking lots, disasters, agriculture/irrigation, participation, data set creation, internal organization, environment/air, lightening. That is to say, municipalities have a strategic goal or plan at the point of public transportation system. This could result from two reasons: The first one is that applications can be exported as a result of the guiding nature of the key policy documents. In general, key policy texts could have an influence; however, it is important to note that this influence is only on junctions. There are goals and plans many fields in the strategic plans. However, it is asserted that smart governance is not available in the local documents. There are quite a low number of municipalities which set an open plan for governance. There is a need for goals, plans and policies which rather focus on human being (Nohutçu and Akpınar, 2022).

6. CONCLUSION

European Commission smart city is a concept "shaped and defined by the factors of economical growth and life quality. In this definition, it is emphasized that goals of a smart city can be provided by means of physical infrastructure, human and social capital, information and communication technology infrastructures." This statement alone presents how the elements in the definition of a smart city concept draw a parallel way and tight connection.

Here, it is important to note that there are different definitions for smart city, partly because every city has specific needs. Applications for the needs of a sample smart city would not bring about effective and efficient results in different cities.

Examples around the world indicate that cities have their own applications, along with the common applications within the concept of sustainability. Thus, it will be useful for Turkish cities to produce their specific applications in terms of efficiency, effectiveness and economy policies.

In general, it can be said that the documentation in the national scale have left the policies of smart cities to local administrations and had an encouraging role in that sense. Furthermore, there is a major source of reference in the preparation process of local administration strategic plans. The local administrations' relatively good performance in the field of smart mobility demonstrates that they are dependent on the higher political documentation in this regard.

To mention the existing situation in Turkey, we can say that smart city concept is taken serious in terms of reference documents, strategies. Moreover, we can also add that local managements have intense studies on that subject. However, the required availability of the smart society, which is a significant point, each city having different smart city requirements seem to become of secondary importance. This leads smart cities to simply become digital cities which have similar projects. Although the intention is good, the smart city sprit does not seem to have been fully comprehended.

Accordingly, local administrations' organizations of smart cities should be expanded and they should appear more frequently in plans and programs. In the national scale, on the other hand, local administrations should be materially supported to realize their applications. Nevertheless it can be stated that it is a critical process to be advanced at.

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