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Research Article

Evaluation of The Smart City Applications in Terms of Users: The Case of Turkey

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Abstract

Cities transform into dynamic, productive, innovative and attractive areas. Due to this transformation, some problems occur in urban areas such as health, energy, traffic, waste management, air and water pollution, unplanned urbanization. The use of communication and information technologies should be provided for solving these problems. The cities should be more livable, quality and functional areas. Planners and designers should try to find solutions to urban problems, and they should action to make cities the more "smart". To create smart cities, areas must be transformed into more sustainable and livable. Smart cities focus on solutions such as mobility/transportation, clean energy, water-food production, health, life, and public participation. The aim of the study is to evaluate the smart city applications in open-green areas according to user's opinion. For this purpose, the questionnaire was made on 455 people who are from all provinces and regions of the Turkey. The users who participated in the questionnaire, were selected on a voluntary. The results that were obtained from the questionnaire, were transferred to SPSS software, and analyses were made using some test in SPSS. The average of the answers that were given by the participants about the smart city applications, is slightly higher than the average of the answers that were given about the park information systems. Most of the participants stated that they have demands about the information and technology, and smart city applications will increase the level of perception the cities. Finally, suggestions for the smart city applications were made.

Keywords: Smart City, City, User's opinion, Questionnaire, Turkey.

Akıllı Kent Uygulamalarının Kullanıcı Görüşleri Doğrultusunda Değerlendirilmesi: Türkiye Örneği

Öz

Şehirler dinamik, üretken, yenilikçi ve çekici alanlara dönüşmektedir. Bu dönüşüm nedeniyle sağlık, enerji, trafik, atık yönetimi, hava ve su kirliliği, plansız kentleşme, doğal kaynakların azalması gibi bazı sorunlar ortaya çıkmaktadır. Bu sorunların çözümü için iletişim ve bilgi teknolojilerinin kullanımı sağlanmalıdır. Şehirler daha yaşanabilir, kaliteli ve işlevsel alanlara dönüştürülmelidir. Plancılar ve tasarımcılar sorunlar için çözümler bulmaya çalışmalı ve şehirleri daha "akıllı" hale getirmek için harekete geçmelidirler. Akıllı şehirler oluşturmak için alanların daha sürdürülebilir ve yaşanabilir hale getirilmesi gerekmektedir. Akıllı şehirler hareketlilik/ulaşım, temiz enerji, su-gıda üretimi, sağlık, yaşam ve halkın katılımı gibi çözümlere odaklanmaktadır. Bu çalışmanın amacı açık yeşil alanlardaki akıllı şehir uygulamalarını kullanıcının görüşüne göre değerlendirmektir. Bu amaçla, Türkiye'nin tüm il ve bölgelerinden 455 kişi üzerinden anket çalışması yürütülmüştür. Ankete katılan kullanıcılar gönüllü olarak seçilmiştir. Anketten elde edilen sonuçlar SPSS yazılımına aktarılmış ve çeşitli testler kullanılarak analiz edilmiştir. Anket sonucunda; katılımcıların akıllı şehir uygulamaları ile ilgili verdikleri cevapların ortalaması, park bilgi sistemleri hakkında verilen cevapların ortalamasından biraz daha yüksektir. Katılımcıların çoğu bilgi ve teknoloji konusunda taleplerinin olduğunu ve akıllı şehir uygulamalarının şehirlerin algılama düzeyini artıracağını belirtmişlerdir. Çalışmanın son kısmında akıllı şehir uygulamaları için önerilerde bulunulmuştur.

Anahtar Kelimeler: Akıllı Kentler, Kent, Kullanıcı Görüşleri, Anket, Türkiye.

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1. Introduction

People intense pressure on natural resources in order to live comfortably. In addition, with the increase in the quality of urban life and the development of the economy, the resources in the world are not able to meet the needs (Zhang, 2019). The urban population is gradually increasing, also density of the urban areas is increasing. Migration from rural to urban areas causes many problems in the urban structure. Not only the increase in the population in urban areas, but also the industrialization, construction, and reduction of the open-green areas cause unplanned or uncontrolled of the urban development. The unplanned and uncontrolled urbanization causes serious problems in terms of the ecological sustainability. With unplanned urbanization, natural landscape features decrease, and the ecological structure and function of the regions decrease gradually (Liu and Wen, 2019). As a result, we face ecological environmental problems in urban areas. Due to overpopulation, cities have many problems such as confusion, informality, traffic, health, waste, energy, water and air pollution, urbanization, reduce to resources, increase the crime amounts. Such problems in the cities; it triggered the emergence of new perspectives in planning, design, finance, urban infrastructure, operation and services. Public administrations and local governments focused on finding solutions to the problems, and developing new strategies.

There are many methods for solving the problems which occur in the cities. These are; prevent migration from rural areas to the cities, planned urban growth, reducing pressures on natural resources, and increasing the amount of open-green areas. In addition to these methods, urban development and sustainability must be provided with innovative methods (Chen et al., 2019). In this sense, one of the method which are the most preferred in the urban areas, is "smart city applications". With smart city applications, it is possible to protect the natural resources of the growing city, increase the quality of the cities, and reduce the health problems occurring in the cities (Gu and Wang, 2012; Su et al., 2020). Therefore, landscape model that can adapted to economic development, ecological sustainability and regional landscape characteristics, should be developed (Ou and Xia, 2017). The most important problem which is should be solved in this issue, is to provide the optimization of urban development with the land use (Groot et al., 2018). Change of the information and communication technologies in the city life cause develop the culture and habits of the citizens very quickly. As a result of this transformation, the demands and expectations of the citizens are moved to completely different dimensions.

The "smart city" vision was developed to improve the cities quality using sensors, network connections, inter-object interaction and communication, governance and e-governance, e-government, sustainability, and human orientation. Smart applications are produced for practical solutions to the population density in the city by combining technology with life to improve the quality of life for citizens.

Also, the cities become more digital, and the cities gains digital identity thanks to smart applications. Therefore, this situation has increased the birth and spread of smart city projects. Smart city applications can be provided urban solutions by taking into account the land uses rather than the change of urban structure.

Studies that were conducted in recent years, are aimed at ensuring a planned urban development by linking the trio of quantity, quality and ecology (Chen et al., 2019; Strauch et al., 2019). The smart city applications can be successful with the combination of new technologies and smart infrastructures. The success of the smart city applications has a close relationship with the information and communication technologies. It should be noted that smart city applications are deeply connected to the seductive and normative visions of the future (Bilici and Babahanoğlu, 2018).

Smart city applications are known as a service which is the optimize the city applications with information and communication technologies. It is possible to define the concept of smart city as an understanding that aims to address the problems through information and communication technologies involving a multi-stakeholder group. The continuity of the smart cities is possible through the transfer of land information. The better management of the city, the applications that are used by the residents of the city and making life easier, occur only with the management of the existing information. Each definition which is brought to the concept of smart city, pays attention to another or several dimensions of smart city. Smart cities should have three main features: innovation, problem solving skills, and information-communication technologies.

The most important component of these features is to solve the problems and the integration of technology into urban life. The smartness of the city is the internal quality of the region where innovation processes are facilitated by information and communication technologies. The degree of smartness depends on the opportunities of the digital infrastructure that are offered to the people. In addition, one of the most important aims of the smart city applications is that the involvement of the citizens in decision making processes. The more the communication between the local administrations and the locals starts to shift from the traditional style to the digital setting, the more effective, widespread and faster the citizen participation will occur. (Örselli and Akbay, 2019).

It is possible to gather studies on the smart city applications under 3 groups. One of these is the smart city application in certain parts of the city. Ateş (2020) stated the advantages of the smart city applications in the cities transportation systems. In the second group, there are studies to determine the effect of smart city applications on urban innovation. Taşyürek and Çelik (2020) examined that on smart stop systems that are used in cities. Tomaş and Dostoğlu examined smart house with artificial intelligence. Caragliu and F. Del Bo (2019) analyzed the technological advances caused by smart city applications in 309 European metropolitan cities.

In the last group, there are studies on economic development, which was developed by ensuring urban sustainable growth and optimization of smart city practices. Cao (2020) aimed to find the solution and mechanism of action of green development policies and measures on the urban economy. Finally, they found that innovation-oriented strategies have a positive effect on green development, and different innovation-oriented initiatives play different roles in economic green development.

Özdemir and Güngör (2019) tried to explain ecological planning principles in smart city applications. However, there are no studies on the effects of smart city applications on open-green areas.

In this study, it was tried to be determined what the expectations of people in the park, which is one of the urban open-green areas, within the scope of smart city applications using qualitative methods. Conducting such a study on both a national and international scale will be a guideline for how smart city applications should be in the park designs that will be made future. The aim of this study is to evaluate the smart city applications in open-green areas according to user opinion. The study has certain limiting factors. Smart city applications in our country is a very current issue, and there is no application in the areas that we can take as an example. Therefore, a visual example for the smart city applications could not be presented to the users. This is one of the points where the work is lacking in terms of informing the participants. Within the scope of this study, this deficiency tried to be eliminated as much as possible. The users were told about the smart city applications, and then the questionnaire started. In addition, the questions that were asked in the questionnaire, were selected for smart city applications in Europe, and user's opinions were determined.

2. Material and Method

Questionnaire was made to determine the user's opinions and demands for the smart city applications in Turkey. The questionnaire consists of 4 parts and 17 questions. In the first part, demographic characteristics of the users who participated in the questionnaire, were determined.

In the second part of the questionnaire, the purpose of the users which come to the parks, the time of their stay in the parks, and the reasons for their preference, were determined. In the third part of the questionnaire, the expectations of the participants were determined. In the last part of the questionnaire, the opinions of the participants about the information systems of the parks and cities were determined.

According to TUIK (2019), the population of the Turkey is 82.000.000 in 2019. Region that has population size of up to 1.000.000, questionnaire is required on 383 people in a 95% confidence interval (Yazıcıoğlu and Erdoğan, 2014). It was thought that there might be deficiencies in the questionnaire, and 455 people were participated to the questionnaire.

The users who participated in the questionnaire, were selected on a voluntary. The results that were obtained from the questionnaire, were transferred to the SPSS software, and the results were analysed using frequency analysis. Finally, suggestions for smart city applications and parking information systems were developed.

3. Results and Discussion

Demographic characteristics of the participants are given in Table 1. Most of the participants live in Istanbul, Ankara, Izmir, Antalya and Adana which are the big cities in Turkey.

Table 1. Demographic characteristics of the participants

Questions	Answers	Number	Percent	Std. Error
Gender	Male	149	32.7	.022
	Female	306	67.3	
Age	Under 18 age	7	1.5	.044
	18-25	301	66.2	
	26-35	68	14.9	
	36-45	54	11.9	
	46-55	21	4.6	
	55-65	4	0.9	
Child or children	No	372	81.7	.043
	1	17	3.7	
	2	43	9.5	
	3	18	4.0	
	4	3	0.7	
	Above 4	2	0.4	
Education	Primary School	3	0.7	.029
	Secondary School	5	1.0	
	High School	54	11.9	
	Undergraduate	352	77.4	
	Postgraduate	31	6.8	
	Doctorate	10	2.2	
Profession	Student	269	59.1	.082
	Public	68	14.9	
	Self-employment	13	2.9	
	Private sector	59	13.0	
	Housewife	15	3.3	
	Retired	4	.9	
	Other	27	5.9	

Continuation of Table 1

Questions	Answers	Number	Percent	Std. Error
Marital Status	Single	366	80.4	.019
	Married	89	19.6	
City	Antalya	126	27.7	.097
	İstanbul	93	20.4	
	Ankara	41	9.0	
	İzmir	34	7.5	
	Adana	21	4.6	
	Other	140	30.8	

A total of 140 people from the other regions participated in the study, and this number was distributed equally by regions.

The opinions of the participants about the parks, are given in Table 2.

Table 2. The opinions of the participants about the parks

Questions	Answers	Number	Percent	Std. Error
Participation in the parks	Alone	65	14.3	.023
	Family	160	35.2	
	Friends	230	50.5	
Park preference	Children's park	85	18.7	.014
	Mini parks	91	20.0	
	Theme parks	141	31.0	
	Wayside parks	77	16.9	
	Neighbourhood parks	157	34.5	
	District parks	135	29.7	
	Region parks	103	22.6	
	National parks	147	32.3	
	Urban parks	208	45.7	
Density of going to parks	Daily	9	2.0	.020
	2-3 days a week	66	14.5	
	1 day a week	84	18.5	
	1 in 15 days	76	16.7	
	Once in a month	173	38.0	
	Never	47	10.3	
Duration of stay in the parks	0-1 hours	115	25.3	0.18
	1-2 hours	198	43.5	
	2-3 hours	105	23.1	
	3-5 hours	27	5.9	
	Above 5 hours	10	2.2	
Time range	06.00 - 08.00	7	1.5	.017
	08.00 – 10.00	32	7.0	
	10.00 – 12.00	32	7.0	
	12.00 – 14.00	55	12.1	
	14.00 – 16.00	140	30.8	
	16.00 – 18.00	186	40.9	
	18.00 – 20.00	159	34.9	
	20.00 – 22.00	102	22.4	
	Late than 22.00	49	10.8	
Transportation to parks	Public transport vehicles	135	29.7	.021
	Private car	176	38.7	
	Bicycle	32	7.0	
	Pedestrian	316	69.5	
	Other	8	1.8	

The responses of the participants about the smart city applications are given in Table 3. The questions which were asked within the scope of smart city applications, were scored very insignificant as 1 point, and very significant as 5 point.

The average of all questions is over (3.5). While the highest average disabled individuals were route information (4.26), the lowest average was the infrastructure information of the city (3.65).

Table 3. Participant's opinions on the smart city applications

Questions	Answers	Number	Percent	Mean
Information about the parks which are located near me, should be given	Very Insignificant	19	4.2	3.71
	Insignificant	39	8.6	
	No idea	85	18.7	
	Significant	222	48.8	
	Very significant	90	19.7	
Traffic condition should be given	Very Insignificant	13	2.9	3.95
	Insignificant	38	8.3	
	No idea	50	11.0	
	Significant	213	46.8	
	Very significant	141	31.0	
Information about the activities in the city should be given	Very Insignificant	18	4.0	4.03
	Insignificant	30	6.5	
	No idea	35	7.7	
	Significant	210	46.2	
	Very significant	162	35.6	
Information should be given about street lighting in the city	Very Insignificant	23	5.1	3.95
	Insignificant	40	8.8	
	No idea	43	9.5	
	Significant	179	39.3	
	Very significant	170	37.3	
Information about Wi-Fi areas in the city should be given	Very Insignificant	27	6.0	3.97
	Insignificant	40	8.8	
	No idea	46	10.1	
	Significant	147	32.3	
	Very significant	195	42.8	
Information about crowded in the city should be given	Very Insignificant	24	5.3	3.82
	Insignificant	41	9.0	
	No idea	66	14.5	
	Significant	186	40.9	
	Very significant	138	30.3	
Information about renewable energy should be given.	Very Insignificant	26	5.7	3.73
	Insignificant	40	8.8	
	No idea	87	19.1	
	Significant	180	39.6	
	Very significant	122	26.8	
Information about the air pollution in the city should be given	Very Insignificant	18	4.0	4.02
	Insignificant	27	6.0	
	No idea	58	12.7	
	Significant	178	39.1	
	Very significant	174	38.2	
Information about the weather condition should be given	Very Insignificant	16	3.6	4.02
	Insignificant	32	7.0	
	No idea	44	9.7	
	Significant	169	37.1	
	Very significant	194	42.6	

Continuation of Table 3

Questions	Answers	Number	Percent	Mean
Information about the disabled routes should be given	Very Insignificant	13	2.9	4.26
	Insignificant	20	4.4	
	No idea	32	7.0	
	Significant	160	35.2	
	Very significant	230	50.5	
Information about the city infrastructure should be given	Very Insignificant	27	5.9	3.65
	Insignificant	48	10.6	
	No idea	97	21.4	
	Significant	164	36.1	
	Very significant	119	26.0	
Information about the smart transportation should be given	Very Insignificant	19	4.2	4.14
	Insignificant	23	5.1	
	No idea	35	7.7	
	Significant	175	38.5	
	Very significant	203	44.5	
Information about the smart garbage applications should be given	Very Insignificant	17	3.7	3.83
	Insignificant	44	9.7	
	No idea	74	16.3	
	Significant	181	39.9	
	Very significant	139	30.4	
Information about the recycling should be given	Very Insignificant	19	4.2	4.06
	Insignificant	25	5.5	
	No idea	49	10.8	
	Significant	178	39.2	
	Very significant	184	40.3	
İnformation of the hospital and pharmacy should be given	Very Insignificant	14	2.9	4.17
	Insignificant	26	5.7	
	No idea	50	11.0	
	Significant	149	32.8	
	Very significant	217	47.6	
The nearest parking lot and it's space information should be given	Very Insignificant	19	4.2	4.03
	Insignificant	33	7.3	
	No idea	50	11.0	
	Significant	166	36.5	
	Very significant	187	41.0	
Charging stations should be given for electric vehicles	Very Insignificant	30	6.6	3.82
	Insignificant	33	7.3	
	No idea	68	15.0	
	Significant	181	40.0	
	Very significant	142	31.1	
Information of the schools which located near me, should be informed	Very Insignificant	30	6.6	3.66
	Insignificant	51	11.3	
	No idea	82	18.1	
	Significant	171	37.7	
	Very significant	120	26.3	
Smart meter (Electricity, Water, Gas) application should be developed and integrated into the smart city information system.	Very Insignificant	29	6.4	3.71
	Insignificant	40	8.8	
	No idea	94	20.8	
	Significant	159	35.1	
	Very significant	132	28.9	

The responses of the participants to the questions asked about the parks information systems are given in Table 4.

Except for one questions, the average of all questions is over (3.5).

Table 4. The responses of the participants to the questions asked about the parks information

Questions	Answers	Number	Percent	Mean
Information about the sunny and shade conditions of the parks should be given	Very Insignificant	19	4.2	3.71
	Insignificant	67	14.7	
	No idea	51	11.2	
	Significant	207	45.5	
	Very significant	111	24.4	
Information about the temperature of the parks should be given	Very Insignificant	14	3.1	3.74
	Insignificant	66	14.5	
	No idea	59	13.0	
	Significant	201	44.1	
	Very significant	115	25.3	
Unobstructed route information of the parks should be given	Very Insignificant	15	3.3	4.11
	Insignificant	28	6.2	
	No idea	48	10.6	
	Significant	165	36.3	
	Very significant	199	43.6	
Areas for animals should be indicated	Very Insignificant	13	2.9	4.16
	Insignificant	29	6.4	
	No idea	35	7.7	
	Significant	173	38.1	
	Very significant	205	44.9	
Security information of the parks should be given	Very Insignificant	15	3.3	4.23
	Insignificant	19	4.2	
	No idea	33	7.3	
	Significant	166	36.6	
	Very significant	222	48.6	
Information about the land uses of the parks should be given	Very Insignificant	12	2.6	4.19
	Insignificant	25	5.5	
	No idea	38	8.4	
	Significant	168	37.0	
	Very significant	212	46.5	
Transportation and route information of the parks should be given	Very Insignificant	15	3.3	4.13
	Insignificant	26	5.7	
	No idea	46	10.1	
	Significant	166	36.6	
	Very significant	202	44.3	
Wi-Fi and charge points information in the parks should be given	Very Insignificant	18	4.9	4.00
	Insignificant	33	7.2	
	No idea	54	11.0	
	Significant	177	39.0	
	Very significant	175	37.9	
Information of the crimes in the parks should be given	Very Insignificant	30	6.5	3.75
	Insignificant	38	8.4	
	No idea	90	19.9	
	Significant	152	33.6	
	Very significant	147	31.6	
Information about parking density in the parks should be given.	Very Insignificant	26	5.7	3.98
	Insignificant	30	6.6	
	No idea	44	9.6	
	Significant	178	38.9	
	Very significant	179	39.2	
Information should be given about the working hours of irrigation systems in the parks	Very Insignificant	16	3.5	3.85
	Insignificant	42	9.3	
	No idea	71	15.1	
	Significant	190	41.9	
	Very significant	137	30.2	

Continuation of Table 4

Questions	Answers	Number	Percent	Mean
Information about the lighting hours of the parks should be given.	Very Insignificant	20	4.4	3.97
	Insignificant	30	6.6	
	No idea	57	12.5	
	Significant	184	40.4	
	Very significant	164	36.0	
Information about the names of the plants in the parks should be given	Very Insignificant	18	4.0	3.53
	Insignificant	65	14.3	
	No idea	107	23.5	
	Significant	189	41.5	
	Very significant	76	16.7	
Information about the names of the allergic plants in the parks should be given	Very Insignificant	13	2.9	4.15
	Insignificant	27	6.0	
	No idea	45	9.9	
	Significant	164	36.2	
	Very significant	206	45.0	
Information should be given about the flowering time of plants in the park.	Very Insignificant	25	5.5	3.53
	Insignificant	55	12.1	
	No idea	120	26.5	
	Significant	162	35.8	
	Very significant	93	20.1	
Information should be given about the fertilization times of the plants in the parks.	Very Insignificant	26	5.7	3.58
	Insignificant	51	11.3	
	No idea	116	25.6	
	Significant	153	33.8	
	Very significant	109	23.6	
Information about the reinforcement elements in the parks should be given.	Very Insignificant	19	4.2	3.54
	Insignificant	64	14.1	
	No idea	112	24.6	
	Significant	173	38.0	
	Very significant	87	19.1	
Information about the sports activities in the parks should be given.	Very Insignificant	11	2.4	4.09
	Insignificant	30	6.6	
	No idea	49	10.8	
	Significant	180	39.6	
	Very significant	185	40.5	
Information should be given about the bright areas of the parks in the evening	Very Insignificant	16	3.5	4.02
	Insignificant	31	6.8	
	No idea	52	11.5	
	Significant	182	40.2	
	Very significant	174	38.0	
Information should be given about the lighting elements which have sensors.	Very Insignificant	30	6.6	3.52
	Insignificant	64	14.1	
	No idea	100	22.1	
	Significant	159	35.1	
	Very significant	102	22.1	
Information about the time that was spent in the parks, should be given	Very Insignificant	55	12.1	3.39
	Insignificant	51	11.2	
	No idea	103	22.9	
	Significant	151	33.3	
	Very significant	94	20.5	
Density information of the parks should be given	Very Insignificant	28	6.2	3.76
	Insignificant	41	9.0	
	No idea	70	15.4	
	Significant	188	41.4	
	Very significant	128	28.0	

The below-average question is about the time people spend in the parks. While the highest average security information of the park (4.23), the lowest average was information about the time that was spent in the park, should be given (3.39).

As a result of the questionnaire, the average of the answers that were given by the participants about the smart city applications, is slightly higher than the average of the answers that were given about the park information systems. The average of the responses about smart city applications was 3.98.

The average of the responses about park information systems was 3.79. Especially in the answers which were given about the park information systems, the average of the information about digitization, unobstructed route and safety is very high.

Cross-examines were conducted to determine whether there were differences in the answers that were given to the questionnaire's questions according to groups. For this, chi-square analysis in SPSS.20 software was used. In general, there was no significant difference in cross-examines ($p>0.05$). It was determined that park preferences changed only by sex. According to the results of the analysis, men prefer neighbourhood parks, while women prefer city parks.

For the questions about the smart city applications, while men want more information about traffic density than women, women want more information about the knowledge of the near parks than men. The answers are in the same direction and it shows that people's expectations regarding the smart city applications and park information systems are similar. Particularly, the answers that were given to the questions about smart city applications, are similar, and people expect the information to be transmitted by digital methods. In Turkey, people generally prefer the city park. City parks must have certain standards. Some features such as size, land use etc. should be considered in the design of the urban parks, and designed accordingly. Nowadays, most of the urban parks which are located in Turkey, does not have a design related to smart city systems. With this study, the importance of applying the smart information systems in these areas was determined. In addition, people stated that they go to the parks once a month. This is a very low rate. It is necessary to increase this rate and bring in activities that will increase the time people spend in the parks.

In some cities, it is possible to see the applications on the smart city in Turkey. For example, Konya has smart city applications such as "smart public transport system", "contactless card system", "smart junction system", "smart bike system", "smart waste management", "mobile applications", "city information system". However, these uses are related to public transportation, historical sites and recycling. They provide unlimited contributions in terms of economy and ecology. However, these activities should not be limited in certain areas, but should be expanded.

Lack of the smart city application especially for the open-green areas that people use intensely, will cause many problems, such as traffic and environmental pollutions. 69.5% of the people who was participated the questionnaire, access to park by walking. Especially in summer, temperatures are very high in Turkey. Therefore, it is necessary to develop smart systems that show the air temperature and the state of the park especially for people who provide transportation by walking. After that, people generally use their private vehicles (38.7%).

For people who provide transportation by car, systems providing information about parking density of the areas and traffic density of the city should be developed.

Urban structure is the basic building block for smart and ecological cities. In order to ensure the formation of the smart and sustainable cities, ecological principles should be taken into consideration and technology should be combined with ecology. For this reason, the cities must be smart for sustainable development. Information technologies are important in smart city applications, but ecological aspects should not be ignored. In the ecological city concept, which is the basis of more sustainable urban designs, we act with technology that increases ecological awareness with the nature-oriented design approach and takes into account the local climate and green area structure. Only in this way smart and sustainable city concept can be developed together. For the smart and green cities, natural elements should be considered and the destruction and unnecessary use of the nature should be avoided.

By following the technological developments that will enable the use of nature more efficiently, smart city methodology should be combined with green city and sustainability principles. Today, smart solutions such as monitoring air and water pollution with sensors, provide the energy savings. Also new smart buildings such as integration of technological housing areas are used for smart city application. The best examples of the smart city applications in east countries and European cities; It is implemented in Paris, London, Berlin, Singapore, Barcelona and Amsterdam. These cities are the cities that have smart city elements and each developed similar city models and strategies besides similar features (Çetin and Çiftçi, 2019).

In London, 'London Environmental Strategy' aims to achieve zero carbon emissions and at least 50% green space. By providing incentives for electric vehicles, 'Zero Emission Areas' are created where zero emission vehicles can enter. The non-profit 'Open Data Institute', which supports Smart London, was established. With the security cameras mounted on the body, the security officers work more transparently. With the Oyster Card, which is a contactless payment system in transportation, time savings were achieved.

A navigation system has been installed at London Underground Station for disadvantaged groups. With the "Talk London Initiative", question and answer activities were held and people were included in the planning process. By establishing the "Croydon Technology Centre", the infrastructure for innovative studies was created. With the London infrastructure application, the urban development process is under control and monitored. With the "London Data Store", it is aimed to quickly identify the needs of the city with the maximum efficiency of big data. Such applications are made in Turkey, can contribute to work towards smart city applications. In this context, it is very important that local and central governments provide the necessary financial support and encourage public participation.

The transition to the smart city applications with the development plans and programs in Turkey since the 2000s, the National Science and Technology Policy and Vision 2023 has been applied with policy documents. The first smart city application is the action of establishing an ecological settlement called 'Information Valley Project' in Yalova. Informatics based Smart City projects were then continued with cities such as Istanbul, Ankara, Izmir, Kocaeli, Bursa, Eskişehir, and their applications were started in other cities.

In the 10th Development Plan which covered the years of 2014-2018, indicated that "the use of smart city applications, especially in the fields of health, transportation, building, energy and disaster and water management will increase, and the infrastructure and capacity of the cities to smart cities transformation will be supported" (Bilici and Babahanoğlu, 2018).

Similar results were found in other studies on these subject. Luvizi and Lorenzini (2014) stated that virtualization of green areas using sensors and mobile devices can lead to digital management of urban green and real-time navigation in all areas. Sun and Zhang (2020) stated that the implementation of smart cities preserves 20% of urban resources and the region's industry has grown on average by more than 30% annually. Angelidou et al., (2018) emphasized the need to explore the relationship of smart and sustainable cities more systematically, focusing on practical applications that will enable a better understanding of typologies and design concepts. Li and Yiğitcanlar and Teriman (2015) identified urban planning and development issues for the integration of smart urban technologies and their possible effects on shaping the built environment to produce sustainable urban futures. As a result of all these studies, we can say that the integration of smart city applications with urban ecological models and urban development is very important.

Smart transportation, smart security, smart energy, smart health, smart buildings and smart life applications, which meet the needs of the increasing city population, produce solutions to increasing demands and follow technological developments, are smart city solutions. With smart economic solutions, applications that will contribute to the development of the city are applied. In summary, when smart city applications are evaluated, although smart applications are put into operation by separate units, the concept of an integrated smart city will come up with the smart urbanization approach in the near future.

4. Conclusions and Recommendations

The rate of the urbanization in the world has been rapidly increasing. In parallel with this phenomenon, there is a continuous increase in the population of the cities. As a result of the researches, it has been obtained that the population of the cities will continue to increase. This situation made it almost imperative for cities to become more efficient, healthier and more accessible. Many innovations, changes and regulations have been implemented in the urban environment since the cities emerged.

These innovations, changes and regulations have been made to greatly increase the welfare of citizens, and improve living conditions. Today, transformation is evolving towards building “smart cities”. When the smart city applications in Turkey are evaluated, compared with practices in the world which was done on this issue, it can be stated to be fairly new.

The smart city applications that are carried out give importance only to the technological dimension of the subject; it is seen that other components that make up the smart city are ignored. Some information technology companies, smart city practices implemented as state supported, both add a vision to local administrations and lead public policies implemented in this field. In this context, it is seen that especially in some metropolitan cities, there are some important and successful smart city applications (Bilici and Babahanoğlu, 2018).

Today's cities contain all kinds of problems. Therefore, if urban spaces cannot be managed properly, undesirable consequences may arise when the majority of the population lives in cities. As a matter of fact, smart city vision was created by revealing the plan of a futuristic city that associates a new artificial intelligence with information and communication technologies.

Many authors in the literature have limited the framework of the smart city as a "solution to urban challenges". Therefore, it has been argued that the way to implement a good smart city model is through a good urban planning that takes advantage of the opportunities of technology. In this context, in order to evaluate a city as a smart city; A system consisting of smart economy, smart governance, smart mobility, smart environment, smart life, smart technology, smart infrastructure and most importantly, smart citizens who will accept and use all these smart solutions must be established.

It is seen that countries which have high level of development, strong economies and strong capital structure, are at the forefront of the smart city market. Smart cities need a very serious cost, a strong infrastructure in information and communication technologies. When these developments Turkey reflections on a world scale evaluation; the cities were affected by these developments and were included almost every city very slight smart city applications. It can be said that especially the cities with high income level are ahead and many smart city applications are implemented. It is observed that these applications are generally smart traffic, smart parking systems, information services, unmanned aerial vehicles and map drawing, applications for disabled people, and partially solar energy production in solar panels. In this context, the limited application of smart city in Turkey, but began to be said that the promise of hope for the future (Örselli and Akbay, 2019). Today, we can say that every system has started to be digitalized. As a result of the study, it has been determined that people will participate in a model to be created about smart city management and park information systems. As a result, the future of mankind will be shaped in smart cities, new generation cities will focus more on the internet and user-oriented services, and the biggest contribution to smart cities will be information and communication technologies and infrastructures.

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