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ENDÜSTRİ 4.0 KAPSAMINDA AKILLI ŞEHİRLER: RESMİ MOBİL UYGULAMALARIN ANALİZİ[1]

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ÖZET

Sanayileşme süreci, yeni nesil bilgi ve iletişim teknolojileri ile dördüncü kez evrilmeye başlamıştır. Akıllı şehirlerin, rekabet avantajı ve özellikle teknolojiyi aktif kullanan Z kuşağı vatandaşları nedeniyle resmi akıllı mobil uygulamalar aracılığıyla hizmet sunması kaçınılmazdır. Türkiye'de bazı şehirler resmi mobil uygulama yoluyla hizmet vermeye başlamıştır. Ancak, uygulamaların sunduğu hizmetler ve kullanıcıların görüşleri konusunda az sayıda çalışma bulunmaktadır. Bu nedenle çalışmanın amacı, Türkiye'nin ilk beş büyük şehrinin (İstanbul, Ankara, İzmir, Bursa, Antalya) resmi amobil uygulamlarını incelemek ve önerilerde bulunmaktır. Elde edilen sonuçlara göre en çok sunulan hizmetler şehir rehberi, wifi noktaları, sosyal tesisler, toplu taşıma, eczanelerdir. Beş şehrin mobil uygulama yorumları genel olarak değerlendirildiğinde, kullanıcıların çoğunlukla uygulamaların bazen çalımadığından şikâyet ettiği söylenebilir.

Anahtar Kelimeler: Endüstri 4.0, Akıllı şehir, Resmi uygulamalar

SMART CITIES IN THE SCOPE OF INDUSTRY 4.0: ANALYSIS OF OFFICIAL APPLICATIONS

ABSTRACT

The industrialization process has started the evolve fourth time with the new generation of information and communication technologies. It is inevitable that smart cities will provide services through the official application (app) due to gain competitive advantage and especially Z generation citizens actively using technology. In Turkey, some cities have now started to serve through the official application. However, there are paucity of studies on the services provided by the applications and the opinions of the users. Therefore, the aim of the study is to examine the official applications of the first five major cities of Turkey (Istanbul, Ankara, Izmir, Bursa, Antalya) and to give suggestions. According to the results, the most offered services are city guide, wifi points, social facilities, public transport, pharmacies. When the comments of the five cities' applications are evaluated in general, it can be said that the users mostly complain that the applications are sometimes broken.

Keywords: Industry 4.0, Smart city, Official applications

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INTRODUCTION

While advances in technology have distorted all memorization, new concepts are placed in every area of life. The concept of smart tourism has become widely used to processes that use all kinds of technology applications that are developed with the human mind, augmenting human labor, which is the essential element of production. Every word that has an smart title at the beginning shows that it is technology based. In this context; smart cities can be defined as living spaces where new technologies are used to ensure the effectiveness of the traditional services provided by the city administration to residents and foreigners. There is no doubt that restructured sectors in technology-based cities will also be smart.

The concept of smart city emerges due to the complexity and management difficulties faced by the authorities to cope with the rapid growth of the urban population. Harrison et al. (2010) defined "smart" as using real-time and real-world data, integrating, sharing, and using analytics, modeling, and visualization to make better operational decisions. This adjective has been added to cities (smart cities) to define efforts to use innovative technologies to achieve resource optimization, effective and fair governance, sustainability and quality of life (Gretzel et al., 2015).

Many problems started in the first years of the 20th century, such as population growth, traffic problems, excessive consumption of natural resources and environmental pollution due to rapid urbanization, regional development and economic incentives (Kim and Han, 2012). After the implementing the new generation information technology to hospitals, railways, bridges, tunnels, roads, buildings, water systems, dams and pipelines via Internet within the scope of smart cities by IBM firm in order to reduce these problems and provide service to the citizens in the cities (Zhang, 2010) the concept of smart city has started to gain importance. The concept of smart city refers to an environment in which technology integrates with the city. This technology creates synergies with the social components of the city in order to improve the quality of life of citizens and at the same time to reduce energy use and increase the efficiency of city services such as better traffic monitoring (Vicini et al., 2012).

Topsakal et al. (2018) conducted a smart tourism and smart city study, which describes the application of smart city concept and technologies in the context of tourism. In their studies on smart tourism destinations, Topsakal and Çelik (2017) stated that smart cities also increase tourism competitive advantage. Focusing on the functionality and adoption of smartphone applications, Topsakal (2018) stated that local administrations provide numerous benefits to their citizens through smart applications. It is inevitable that smart cities provide competitive advantage and serve cities through official application. In Turkey, some cities have now started to serve through the official application. However, there are paucity studies on the services provided by the applications and the opinions of the users. Therefore, the aim of the study is to examine the official applications of the first five major cities of Turkey (Istanbul, Ankara, Izmir, Bursa, Antalya) and to give suggestions.

SMART CITY AND SMART TOURISM

The concept of smart city has evolved with a technology-centric evolution based on the Internet, mobile services, wireless sensor networks (WSN), smart technologies and the Internet of Things (Monathy et al., 2016). Cities such as Seattle, Singapore, Montreal, Santiago, Amsterdam and Casablanca have attempted to position themselves as smart cities (Khomsi and

Bedard, 2016). According to Komninos (2002) a smart city should solve the problems in that city by using Information and Communication Technology (ICT). Smart cities;

- Uses the existing technology for the citizens and the city,
- Uses digital data to improve the quality of life and the quality of the workplace.
- Integrates ICT with the city,
- Realizes good practices throughout the region to promote innovation, learning and knowledge transfer.

Harrison et al. (2010) stated that a smart city interconnects physical infrastructure, ICT infrastructure, social infrastructure and business infrastructure. Piro et al. (2014) defined smart city as an urban environment supported by a widespread ICT system and stated that smart cities can provide advanced and innovative services to citizens in order to improve the quality of life. Boes et al. (2015) suggested that the technologies used in smart tourism destinations are different from those used in smart cities. For example, the authors state that tourists use technology before, during and after travel; but it is limited to the use of technology in a smart city.

Giffinger (2007) developed a model to determine the scope of the smart city. Giffinger's work was followed by other models defining the dimensions of the smart city (Anthopoulos, 2015). Cohen (2012) identified six dimensions that should be considered in smart cities. These dimensions can be explained as above (Cohen, 2012):

- Smart Environment: Refers to renewable energy sources, ICT supported energy networks, measurement, pollution control and monitoring, renewal of buildings and facilities, green buildings, green city planning, energy efficiency, reuse and resource substitution. City services such as street lighting, pollution reduction, drainage systems and water resources should be monitored by smart city system, pollution should be reduced and water quality should be improved.
- Smart Living: Refers to ICT supported lifestyles, behavior and consumption. Smart living is also linked to high levels of social cohesion and social capital. Smart living offers healthy and safe living in a lively city with cultural diversity and quality housing and accommodation.
- Smart Transportation: It means the smart city has ICT-supported transportation and logistics systems. For example; it should cover sustainable, safe and interconnected transport systems and integrate modes of transport (tram, bus, train, subway, car, bicycle and pedestrian paths).
- Smart Economy: Refers to e-commerce and e-business, ICT-integrated and advanced production / service delivery, ICT-supported innovation, innovative products and services, new business models. The smart economy brings local and global connections and international recognition with the flow of physical and virtual goods, services and information.
- Smart Governance: For example, European Union means a combination of urban and inter-city governance, including services and interactions that integrate effectively and efficiently as an organism. The key facilitating tool to achieve this is ICT, which is provided by data, intelligent processes and interoperability. Smart city can be

defined as a globally networked hub with international, national and hinterland connections. Smart objects include transparency and open data by using ICT and e-government in participatory decision-making and co-created e-services.

- Smart People: Refers to people who work with ICT support, have e-skills, have access to education and training, know human resource management and capacity management, develop creativity and promote innovation.

European Union has defined a roadmap of smart cities, and create interconnecting human capital, social capital and ICTs for more sustainable economic development and better quality of life based on thisroad map (Manville et al. 2014).

The focus of smart cities is the citizens of the city, however smart tourism destinations focus on improving the tourist experience (Figueredo, 2018). In a similar way, Lamsfus and Alzua-Sorzabal (2013) stated that smart city approach focuses on citizens, does not include visitors, and smart destination approach includes tourists and passengers. Wang et al. (2016) provides a conceptual model for smart tourism destinations. According to this model; the basis of the concept of smart tourism destination is an inclusive 'service' logic that directs the design and operation of the destination. The physical characteristics (sources) of smart tourism destinations and the technological state of smart tourism destinations (in terms of cloud computing, Internet of Things, artificial intelligence and mobile communication) shaped the demand for 'new' tourists (Wang et al., 2016). Lamsfus et al. (2015) similarly stated that smart tourism destinations help to develop new services in the tourism industry. For example, smart phones that emerged with the mobile industry have changed the tourism experience and moved the travel and tourism sectors to advanced service areas (Lamsfus et al., 2015). Destination management organizations can spread tourists to a wider area instead of concentrating at certain points. This improves the experience of individual tourists, provides access to a wider set of services, and attracts more tourists and motivates them to stay in destinations for longer (Kramer et al., 2008).

Buhalis and Amaranggana (2014) note that smart tourism destinations require dynamically interconnected stakeholders through technological platforms to gather, create and exchange information that can be used to enrich tourism experiences in real-time. Interconnected tourism organizations provide real-time and personalized services to tourists and also collect data for the optimization of strategic and operational management (Wang et al., 2013). Destination management organizations work as a 'smart center' that collects and distributes all the information about destinations, thus providing a competitive advantage over competitors. According to Buhalis and Amaranggana (2014) smart tourism destinations benefit from the following technologies;

- Technology-based services (Internet of Things, sensors, etc.),
- Micro and macro sensitive processes (smart services),
- End-user devices (smartphones, etc.),
- Stakeholders using platforms actively used to collect information.

Different technologies can be found in smart tourism destinations. Technologies such as QR codes or NFC tags provide links between the physical and digital world. Thus, the value of the tourist experience increases (Chillon, 2012). Su et al. (2011) identified different main applications such as green city, smart medical treatment, smart transportation, wireless city, smart home, smart city management, smart public services and smart tourism in their study on the importance of establishing smart application systems. Basically, a smart city should

integrate human capital, infrastructure and knowledge (Buhalis and Amaranggana, 2014). Since the tourism industry is one of the most suitable industries in which information and communication technology is used extensively in the activities, the idea of smart tourism destinations has found its application area quite quickly. Therefore, the idea of smart tourism destination may be important for destinations where attraction centers are very different and especially difficult to connect and market between them (Koo et al., 2016).

The competitiveness of tourism destinations depends on the extent to which information creation and practices are supported by information and communication technologies-based infrastructure and services (Shaw and Williams, 2009). In this context, Koo et al. (2016) developed a smart tourism destination competitiveness model. According to Wang et al. (2012) there are three stages of tourist experience. These; the prediction phase in which tourists search for information and plan the trip; and the reflective stage of tourists' perceptions of their experiences and their judgment against services.

METHOD

Case study, one of the qualitative research methods, was used in the study. Qualitative research is defined as a study in which qualitative data collection techniques such as observation, interview and document analysis are used, and a qualitative process is carried out to present perceptions and events in a realistic and holistic manner in the natural environment (Yıldırım and Şimşek, 2008). According to Creswell (2007) it is a qualitative research approach in which the researcher deeply examines one or more situations in time by means of data collection tools (observations, interviews, audiovisuals, documents, reports) containing multiple sources, identifying situations and related themes. In this context, the official applications of Istanbul, Ankara, Izmir, Bursa and Antalya Metropolitan Municipality have been downloaded to the smart phone and examined in detail. A word cloud was made through edwordle.net about the fields that five applications serve. Then, the user comments (from IOS and Andorid) given about these applications were examined by content analysis and negative opinions of the users were revealed.

FINDINGS AND DISCUSSION

Table 1 shows the average user scores (over 5) of the official municipal applications on Android and IOS.

Table 1. Application User Score Average

City	Android	IOS	Mean
Istanbul	3.2	4.5	3.9
Ankara	4.1	4.0	4.1
Izmir	3.5	3.0	3.3
Bursa	3.3	4.4	5.5
Antalya	4.5	4.9	4.7

As seen in Table 1, the application with the highest scores in Andorid and IOS belongs to Antalya Metropolitan Municipality. While the application with the lowest score in Andorid belongs to Istanbul, the application with the lowest score in IOS belongs to Izmir.

The official application of Istanbul Metropolitan Municipality (IMM) provide services range from public transport to the traffic situation of the city, from IMM Wifi hotspots to whitetable (complaints and suggestions service). The application is also used in English. City

guide service provides access to information about pharmacies on duty, sports facilities, social facilities. Instant weather is seen through the application. IMM Wifi provides uninterrupted internet access in many points of the city such as the square and the park and in the metrobuses. Thus, current news can be accessed through the application. Touristic cameras in different parts of the city convey live beauties of Istanbul to users. Users can access the indoor and outdoor parking information closest to their location from Ispark points with the application, There are other official applications of the municipality that provides services depending on IMM official application. Users can get real-time traffic information about traffic in the city with IMM Mobile Traffic application, Users can plan their route to their destination in real time using bus, subway, metrobus, ferry and all other amenities with public transportation. Complaints, ideas and suggestions in transportation, infrastructure, environment, zoning, health, social support and other fields can be conveyed and solutions are provided in a short time with the IMM WhiteTable application. QR codes positioned in the social facilities from the gymnasium to the touristic areas can be accessed quickly with up to date information with IMM QR Code application. Users can call the nearest taxi by location with the iTaxi application. Users can access information about Istanbul's attractions and how to get there with the Walk & Discover application. In addition, users can access information about such activities through IMM City Theaters and IMM Culture applications.

The official application of Ankara Metropolitan Municipality was examined within the scope of the study. The application provides access to bus information, water cut information and water bill information. The 14 parks, Sincak shelter, Hacı Bayram-ı Veli Mosque and pet park are watched live by camera through the application. Social and cultural events and on-call pharmacy information are available to users. From the sacrifice part, the question of animal type is made with the number of earrings. City guide feature provides information about health, education, sports, tourism and historical sites. Public transportation, vehicle stops, parking and fuel points are provided with the transportation feature. The application provides access to metropolitan announcements, zoning plans, metropolitan council resolutions, metropolitan council agenda, metropolitan teams' work programs and daily burial information. QR codes are scanned at the points where QR code service is provided and users can access the necessary information with QR code scan feature. Information about free Wifi hotspots offered by metropolitan is presented in the application. In the cultural and social activities section, access to the children theater, adult theater, cinema, festival, concerts, exhibitions, seminars, sports, museums and event calendar is provided. Complaints, ideas and suggestions for transportation, infrastructure, environment, health, social support and other areas can be conveyed to bluetable, and solutions are provided in a short time through the application. The news section of the application provides access to current news. Ankara AR application also serves depending on the official application of Ankara Metropolitan Municipality. When you view posters or billboards with Ankara AR application, you are shown pictures, videos or 3D promotional images about the content.

With the official application of İzmir Metropolitan Municipality, news, announcements and cultural and art activities of the municipality can be seen. From the transportation section; users can learn the buses approaching the station, Bisim (bicycle) station status, izmirim card balances, nearby bus stops, transportation (bus, metro, ferry, car ferry, Izban and tram) hours. The users can see the prices of vegetable and fish, photos of İzmir, results of Eşrefpaşa Hospital analysis, announcements of instant water cuts and pharmacies on duty. Users can get directions to the selected pharmacy on duty. The application provides access to council decisions and Wizmir (Wifi) hotpots. Culture and art activities organized by the Municipality and information about all activities notified to the Municipality throughout Izmir are provided through the

application. Camera broadcasts of historical or important points published by the municipality and the YouTube channel İzmirTUBE are accessed through the application. The application also provides emergency telephone and contact information of Izmir Metropolitan Municipality. Complaints, ideas and suggestions in transportation, infrastructure, environment, reconstruction, health, social support and other areas can be conveyed and solutions are provided in a short time through the application.

Current news, announcements, events and printed publications are provided through official application of Bursa Metropolitan Municipality. In the e-municipality inquiries section, debt inquiry, e-payment, document follow-up, state prices and grave location can be accessible. However, the application for these e-queries directs to the e-municipality website of the municipality. Complaints, ideas and suggestions can be forwarded from the whitetable section in application. Application also has a city guide section. In this section, users can learn places to visit in Bursa and pharmacies on duty with interactive map. The activities section provides information on activities in the city theater, art galleries, youth centers and museums. Metropolitan TV is watched and participation in surveys is provided through the application. The application also offers the contact information of Bursa Metropolitan Municipality.

News, announcements, weather and information about events can seen with the official application of Antalya Metropolitan Municipality. In transportation section, where the bus, bus routes, balance inquiry, information about the nearest stops, balance loading points açan be reached. In city guide section courthouse, hospitals, fuel stations, shopping centers, banks, football fields, basketball fields, mayors, mosques, recreation facilities, safety buildings, baths, zoo, parking lots, churches, port, picnic areas, museums, cemeteries, important points, parks, beaches, post offices, cinemas, tourist information offices can be seen. The tour guide contains information and locations on canyons, ancient cities, streams, caves, museums, parks, waterfalls and resorts. The locations of the free wifi hotspots can be seen through the application. The find taxi section provides information about the nearest taxi stations. Users have access to prices of fruit / vegetables and pharmacies on duty with the application. Information about free sports and fitness centers, arts and vocational training courses and social facilities was provided in the social services part. The e-municipality part provides guidance to the website of the municipality for debts and payment. Complaints, ideas and suggestions can be forwarded through the application. The information about the telephone numbers of the units such as emergency aid and municipal police are included in the application. Antalya Metropolitan Municipality official application has the smart city section. In the smart city section, information about smart irrigation, smart illuminating, kiosk, free wifi, panic button, chronical patient tracking and audi steps for disabled are given.

After examining the official applications of the five metropolitan municipalities, a word cloud was made about the areas they serve. The word cloud is given in Figure 1.

Figure 1. World Cloud of Service Areas of Applications

In the word cloud, the service areas in the five applications are given in a larger to small according to their frequencies. Service areas can be divided into three importance categories according to the weight scores obtained as a result of the word cloud made. The first importance category has city guide, wifi points, social facilities, public transport, pharmacies on duty, events, suggestions, complaints, museums, announcements, debth inquiry, parking, city cameras and city theather words. The second importance category has whitetable, taxis, good prices, bus stops, council decisions, fuel statitons, daily burital, weather, cinemas, historical sites, e-payment, QR code, water cuts, health, emergency numbers, contact information and sports words. The rest are in the third importance category.

The comments of those using the official applications of the metropolitan municipalities were examined for each city. The themes of the comments regarding the official application of the Istanbul Metropolitan Municipality are given in Table 2.

Table 2. Comments of Istanbul Metropolitan Municipality Official Application

Thema	Frequency
Sometimes the application broken	10
Lack of services	7
Cameras failing	4
Does not work with update	3
Activation code errors	3
Bus times are out of date	2
Incorrect location display	2
Incorrect display of traffic density	2
Barcode reading does not work	1
Street names are out of date	1
Wifi error	1

When Table 2 is examined, users of the Istanbul Metropolitan Municipality official application experience the most problems that the application sometimes broken. The second problem is that the application has lack of services.

The themes of the comments on the official application of the Ankara Metropolitan Municipality are given in Table 3. It can be said that the users of the Ankara Metropolitan Municipality official application does not experience much trouble. The most common problem is that the application sometimes broken.

Table 3. Comments of Ankara Metropolitan Municipality Official Application

Theme	Frequency
Sometimes the application broken	2
Wifi error	1
Low number of cameras	1
Lack of e-payment service	1

The themes of the comments regarding the official application of the Izmir Metropolitan Municipality are given in Table 4. The users of the Izmir Metropolitan Municipality official application experience the most problems that the application sometimes broken. The other important problems are the post-update problems, the bus information is sometimes not seen and there is no real-time update in the application.

Table 4. Comments of İzmir Metropolitan Municipality Official Application

Theme	Frequency
Sometimes the application broken	29
Post-update problems	25
Bus times are sometimes not seen	17
No real-time updates	16
Error when displaying balance	10
Lack of services	8
Having a navigation problem	7
Low number of cameras	3

The themes of the comments regarding the official application of the Bursa Metropolitan Municipality are given in Table 5. The users of the Bursa Metropolitan Municipality official application experience the problem that the application broken most of the time. Other important problems are the abolition of the cameras, the lack of services and the small text.

Table 5. Comments of Bursa Metropolitan Municipality Official Application

Theme	Frequency
Sometimes the application broken	7
Abolition of the cameras	6
Lack of services	4
Small text	2

The themes of the comments regarding the official application of the Antalya Metropolitan Municipality are given in Table 6.

Table 6. Comments of Antalya Metropolitan Municipality Official Application

Theme	Frequency
Sometimes the application broken	4
Lack of services	1
Small text	1

When Table 6 is examined, it can be said that the users of the Antalya Metropolitan Municipality official application have not experienced much problems. The most common problem is that the application sometimes broken. When the comments of the five cities are evaluated in general, it can be said that the users mostly complain that the application sometimes broken. Another important issue is the inadequate and incomplete services provided through the application.

CONCLUSION AND RECOMMENDATION

The industrial revolution that emerged in the 1800s has evolved three times with new technologies and innovations that have evolved over the years, and today for the fourth time, has started to evolve again under the name Industry 4.0. Although the first revolutions were developed primarily for wars, they have found application in every industry over time. However, Industry 4.0 and new generation technologies have directly affected all sectors and technology is now the key to competition. Cities have also begun to adapt to Industry 4.0 technologies. For this purpose, cities have started to serve the citizens with smart applications. Some cities in Turkey have developed smart applications and started to provide some services through these applications. The applications of Istanbul, Ankara, Izmir, Bursa and Antalya Metropolitan Municipalities were examined. Considering the results, the following recommendations were given;

- E-payment systems that can be considered as missing services in the applications, city tour arrangement routes should be included and a section should be created for tourists.
- These applications should be promoted at the airport, bus station and touristic places of the city. Even the city tourist cards integrated with the application can be created and sold.
- Users should be able to access city cameras, especially in busy areas, for planning. The problem at this point could be privacy. Necessary legislation and regulations should be made on this subject.
- Applications run according to the users' location. That's why developers need to keep applications up-to-date in order for them to run correctly on most smartphones.
- The times and routes of transportation lines such as buses, ferries and trains are sometimes changed in cities. These changes need to be updated instantly in the application.
- Text in the applications should be international standard size. If necessary, the application's texts should be able to be enlarged or reduced.

The study examined the official applications of the top five cities of Turkey with secondary data. In the following studies, empirical studies can be applied to the users.

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