

## Identifying sensor placement problem in smart tourism through consumer-oriented approach

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### **Abstract**

Tourism activities have shown a rapid growth depending on economic return. The ability to meet expectations in tourism services requires the collection of more information about consumers. Tourism sector has an important source of big data, and there has been a significant opportunity in terms of real-time customer-oriented services creation by using data sensor networks. In this context, it is important to determine sensors' location to collect eligible information. It is necessary to create an effective consumer oriented solution with an optimal cost because of high number and variability of attractiveness. The aim of the research is determining the sensor placement criteria that can be used to collect most effective consumer attitude and behaviour information in order to create the smart tourism area. It was preferred to use the fuzzy AHP method because the information to be gathered contained multiple criteria, differed tourist expectations, and binary comparisons were included. It has been seen that "Direction to tourism attractions of destinations (gastro, entertainment, nature etc.) (attractiveness)" and "guide to popular tourist destination (popularity)" criteria are the main specifications of the locations for the sensor' placement point according to attractiveness preferences of tourists.

**Keywords:** Smart tourism, sensor placement problem, consumer-oriented approach

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## 1. Introduction

Tourism sector is a multi-directional event and has different dynamics due to its demand and structure. Tourism can be described as “holiday, rest, entertainment, travel, temporarily accommodation and etc. in order to meet tourists” needs (Yıldız, 2011; Öztürk and Bayat, 2011). Recently, tourism sector gained acceleration, by the effect of the factors such as abolition of borders, development of transportation sector, technological improvements, social factors, increasing of tourism spending share from disposable income. In addition, the increase in tourism opportunities by the diversification of tourist needs and wants, has made the tourism sector is become one of the fastest developing sectors around the world. These developments in tourism sector have exposed the income potential of the sector and research directed on tourism has increased.

Tourism sector known as "Smokeless industry" come to fore with its feature of providing employment and currency in Turkey. Although Turkey has trying to distinguish from competitors with its natural and cultural values, it has a wide range of alternative tourism opportunities in terms of health and congress tourism. According to World Tourism Barometer' data prepared by World Tourism Organization (WTO), 1 billion 322 million tourists were determined in the world by the end of 2017 and this ratio shows that an increase of 6.7% comparing with the previous year (World Tourism Organization [UNWTO], 2018). According to information received from the data of the Ministry of Culture and Tourism, the number of visitors come to Turkey increased of %27, 84 with compared to last year and rise to 32.41 million people.

Although Turkey is in the list of top ten by the number of tourists in terms of offering travel and service competitiveness, it is possible to expect significant problems of Turkey. Turkish Hoteliers Federation (TÜROFED, 2017) tourism report results are examined Europe and Eurasia in terms of the competitiveness of;

- Service of cultural values
- Infrastructure features
- Access to international facilities
- Secure country image

With the regard to these indicators, although Turkey has reached a strong position, it is seen that Turkey

is not on the list of top ten countries in tourism (TÜROFED, 2017).

The tourism sector, which has a human-oriented perspective, shows a rapid development depending on improvements in the technological environment. Especially, innovations in the informatics sector have brought vitality to the sector as factors driving the service structure and presentation. In this context, conversion that starting with online booking usage, the increase of mobilization, social media development, usage applications, 360-degree virtual tour, augmented reality technology, near field communication systems and similar innovative applications have begun to provide the opportunity to present the touristic attractions with different features (UNWTO, 2011; Han et al. 2016; Yoo et al., 2017; Durmaz et al. 2018).

They are monitoring the environment, collecting the information, evaluating, planning with the help of smart systems, mobile devices, cloud system, cameras, sensors etc. devices and manage by analysing all of these information. The main purpose of smart systems is to make decisions about improving the quality of life by making the use of resources efficiently. Today, applications of smart systems from transportation to production are rapidly increasing in all areas. In this context, it is possible to benefit from smart systems in order to understand changing tourist behaviours and offer services that are met with their expectations effectively. For this purpose, tourists' experiences will be the highest point and the gathering the basic information which is revealed the tourist attractions will gain importance. The sensor networks that can be used in this context will enable easy access to information at any time and any point. After gathering and processing data through interaction with sensor networks, obtained information can be used in marketing studies aimed at the audience with doing all evaluations. The selection of the places where the sensor nodes are to be placed has importance for collecting the necessary information. It is aimed to create an effective solution to set with a limited budget due to the large number of attractiveness points to collect tourist information. In addition, it is important to ensure that tourists are satisfied without disturbance in the process of collecting and disseminating information. This research is based on the reconstituted tourism activities and services on the basis of information systems by the used of smart

systems. The aim of the study is to determine the importance criteria of the points where the sensor nodes should be placed for gathering and disseminating the customer information effectively in order to create the targeted smart tourism area. This study will present a consumer-focused approach to managers in terms of integrating the city's touristic points with smart systems in the case of becoming more important the smart city perspective.

## 2. Literature review

Although tourism movements, which were as old as human history, were firstly realized due to economical, religious, sportive and health reasons, they became an integral part of contemporary life in time, especially after the industrial revolution (Öztürk and Bayat, 2011). Undoubtedly, tourism attractiveness is the most important factor in the emergence of tourism movements. Mayo and Jarvis (1981) describes attractiveness as tourists' perceptions for destinations for satisfying their needs (Vengesayi, 2003; Kutvan and Kutvan, 2013; Nowacki, 2013). Besides the natural features of a destination, it is possible to list the tourism attractions as the attitudes of the local people, price levels, accessibility, climate, recreation opportunities and etc. (Morechat, 2003; Kutvan and Kutvan, 2013; Kresic and Prebežac, 2011). Recently, although nature and cultural elements were the basic criteria for attractiveness decision, the factors of attractions which is supported by technological developments, increased the touristic experience and become a reason for the reshaping of the competition dimension in the tourism sector (Buonincontri and Micera, 2016).

Consumers are differentiated from each other in many different ways, primarily their demographic characteristics (Yapraklı et al., 2018). As a result of these differences, consumer attitudes and behaviours may show significant differences without considering the sector. In addition to this, the information to be collected through effective market and consumer analyses despite the consumer differences makes it possible to understand the consumer and to provide products and services suitable for them. In the tourism sector, this situation is much more complicated due to the large number of dynamics (drivers) that can affect the decision makers as well as the diversity of the customers. A wide range of variables, from holiday destinations to

number of individuals, from facility properties to individual preferences, can create significant uncertainties in demand. Usually, attractiveness is the main factor of the tourist' preferences. Destination attractiveness refers to tourists' perceptions about a destination and its ability to satisfy their needs. Since it is not possible to control the attractiveness, accessing maximum information about consumers and their behaviours, collecting and analysing them will be one of the ways to increase the satisfaction of the tourists and meet their expectations.

The systems connected via the internet have been communicating among themselves and enabling the beginning of smart life. Gretzel et al. (2015) defines the concept of smart, as self-decisive activities supporting technologic, economic and social development by using sensors, big data, open data, new connection paths, technologies based on ICT (IoT, RFID and NFC etc.). Also, Nam and Pardo (2011) describes the concept of smart, as user friendly than intelligent, in a broader sense which is responsive systems to environmental feedbacks. The resource efficiency created by smart applications in different industries has become a solution tool of the problems of the rapidly growing cities. Smart cities connect physical, technological, social and the business infrastructure to support sustainable economic growth, quality of life and activities of aware citizens based on ICT (Giffinger et al., 2007; Caragliu et al. 2009; Harrison et al., 2010; Lombardi et al., 2012). Sustainable Smart Cities Workshop (2017) characterized smart cities with the property of enabling their residents to increase their living standards by the way of collection and analysis data, efficiently. Based on these definitions, it is possible to make the definition as a city system in which problems are solved with the help of information and communication systems that are provided with a nature friendly approach, infrastructure and management.

Smart tourism is a new developing concept in smart city perspective for Turkey. In this context, smart tourism is mostly carried out in micro-locations. Through the development in ICT, data collection process and access to information becoming easier and it has been possible to create customer-oriented and economic services in the field of tourism (Gu et al., 2016). With the increasing usage of e-tourism practices, new market opportunities have emerged for smart tourism applica-

tions (Whertner and Ricci, 2004). Presenting the physical and governance dimensions of tourism in a digital form is a milestone for smart tourism, so, the creation, sharing and consumption of tourism experiences have changed (Gretzel, 2011). Smart tourism practices can increase tourism experience and affect the decisions of citizens and tourists with real-time guidance and information sharing. Today, technologies of cloud computing, big data, mobile applications, geographical information systems, virtual reality, augmented reality, social networking services and etc. have shaping smart tourism practices (Çelik & Topsakal, 2017: 153; Durmaz et al. 2018; Han et al. 2016; Yoo et al., 2017). For example, these technologies can support citizens and tourists by predicting their needs such as decision-making problems, food and beverage recommendations, location-based information and etc. (Steel and Topsakal, 2017). In Amsterdam, there is a smart system working on bicycle services, which is monitoring the instant city' cycling traffic and serving suggestions according to intensity. Generally, these systems can orient the target groups depends on their previous behaviours by using their mobile devices when they are closing to any specific tourist destination.

Studies on smart tourism is mostly focused on the concept of definition and features (Buhalis and Law, 2008; Gretzel, 2015; Minghetti and Buhalis, 2010), destination management (Amanda et al., 2018; Xiang et al., 2015; Yüzbaşıoğlu et al., 2018) and practices on tourism attractiveness (Swedberg, 2010; Gökalp and Eren, 2016; Huang et al., 2017; Yalçinkaya et al., 2018). Smart tourism studies are still at the applied research level and continue to increase rapidly. This paper contributes to the literature in terms of understanding critical factors in order to identify of sensor placement through consumer-oriented perspectives.

### **3. Research methodology**

#### *3.1. Purpose of the research*

Nowadays, sectoral competition is shaped according to the usage of information by the effect of internet age. Due to developments in communication and information technology, such as increasing internet usage, ease access to information and etc. has changing the competitive conditions. Mobile devices have also gained significant importance on tourist planning and decisions making processes. Such a transformation

leads tourism sector to digital dimension. This change influenced the texture of the tourism sector, so competition of destinations starts to focus on increasing the experience of attraction by implementing smart tourism systems. Tourism attractiveness varies according to the expectations of tourists and the number of nodes needed to gather information increases as well. Therefore, the number of destination attractiveness that will sensor placement in terms of gathering tourists' data will be an important cost problem. The aim of the study is to analyse criteria of sensor nodes that will place in order to create a targeted smart tourism area, effectively.

#### *3.2. Research design and data collection method*

Data sensors should be placed at optimal destination depending on tourism attractiveness criteria. For this reason, perception and preferences of attractions come to the fore in order to determine the more critical nodes to placement. Also, common features of the most preferred attractions will also indicate the destinations where the most data can be collected. In this paper, tendency to use mobile tourism applications (trivago, maps and etc.) and traveling more than once for different purposes in a year, have been determinant in selection of sample data because of participant' awareness. So, the sample of the study was selected from people aged between 18 and 45 years who had short or long term trips for any purpose at least three times a year and have a tendency to use mobile tourism applications.

Demographic characteristics and binary comparison of tourist attractions formed the questionnaire and 15 (fifteen) questions were asked to the participants. The researches in the literature were used to determine the tourist attractions given in the questionnaire (Durmaz et al. 2018, Han et al., 2016; Yoo et al., 2017; Kutvan and Kutvan 2013; Kresic and Prebazac, 2011). The questions of paired comparison aim to determine which criteria were more important to participants for directing to attractiveness in mobile applications. Afterwards, five people were chosen and interviewed with them in order to evaluate the attractiveness in questionnaire for their travels. As a result of the preliminary interviews, some of the attractions were changed or eliminated because of being similar or caused misunderstanding from the questionnaire. The

questionnaire was applied to the participants after re-organizing according to the suggestions. As a result of the research, totally five statements were binary compared under 16 subtitles related with attractiveness.

Five basic statements and sub-criteria are given in Table 1.

Table 1. Main and subtitled attractions

<b>Price Advantage (Price)</b>	Discount Shopping Alternatives
	Price Categorization
	Instant Discount Personalization
<b>Information about regional transportation (Transportation)</b>	Providing information about transportation transfers
	Providing information of the best opportunities to access the alternatives touristic attractiveness
	Providing time and distance information between attractiveness
<b>Providing information on visited attractions (Information)</b>	Providing information for complementary touristic activities
	Provide information to person's interest
	Provide instant information during travelling
<b>Guide to popular tourist destination (Popularity)</b>	Direction to most recommended destinations
	Direction to well-known locations
	Direction to the city center points
<b>Direction to tourism attractions of destination (Gastro, entertainment, nature, etc.) (Attractiveness)</b>	Local taste and food attractions
	Leisure tourism attractions (amusement parks, entertainment venues etc.)
	Cultural tourism attractions (historical building, artistic places etc.)
	Nature tourism attractions (nature, natural texture, natural places)

The decision-making group consists of fourteen people but four people with a low tendency to use tourist mobile applications were excluded from the study and 10 people were analysed. As the study was a preliminary study, the number of the decision-making group was limited. Participants are distributed in equal numbers according to their gender, while the average level of using tourist mobile applications during a touristic trip (1-lowest-5 highest) is 4.2.

Fuzzy AHP method has been chosen because of including binary comparisons, multiple criteria for information to be collected and differences in tourist expectations. Thus, the analysis of the comparisons of the participants through linguistic expressions can be realized more effectively. The analytic hierarchy process (AHP) was developed by Thomas Saat in the 1970s and was first used in probability planning problems. AHP is a basic approach whereby weights determine the relative importance of the criteria by establishing a hierarchical structure by determining the weight of the criteria in the whole decision-making process.

Fuzzy logic is an extension of Boolean logic by Lotfi Zadeh in 1965 based on the mathematical theory of fuzzy sets, which is a generalization of the classical set theory. By introducing the notion of degree in the verification of a condition, thus enabling a condition to be in a state other than true or false, fuzzy logic provides a very valuable flexibility for reasoning, which

makes it possible to take into account inaccuracies and uncertainties. Therefore, AHP was combined with fuzzy logic and BAHP (Fuzzy AHP) technique was developed. Fuzzy AHP has emerged as a method that will allow decision-makers to make evaluations in multi-objective decision-making problems and facilitate decision-making in uncertain situations. When making binary comparisons the decision-makers can not reflect the thoughts clearly cannot reflect uncertainty, instead of deciding with fixed values decision making with intermittent values will be given more meaningful results. Fuzzy AHP can be calculated using many methods like Chang Extent Analysis, Liou and Wang Method, Abdel-Kader and Dugdale Method and Kwong-Bai Method. (Dağdeviren, 2007; Oğuz, 2018; Ünal, 2015; Göksu ve Güngör, 2008; Karakış ve Göktolga., 2017).

In this study; the values calculated according to Chang Extended Analysis were arrayed by using Kwong-Bai Method. The scale to be used is given in Table 2. The steps of the fuzzy AHP method can be listed as follows (Şengül et al., 2012):

- Chang extent analysis

Step 1: A function is created for each linguistic term of the assessment scale.

Table 2. Triangular fuzzy conversion scale

Linguistic Scale	Fuzzy Scale	Reciprocal Scale
Just equal	(0,0,0)	(0,0,0)
Equally important	(1,1,1)	(1/1,1/1,1/1)
Weakly more important	(1,3,5)	(1/5,1/3,1/1)
Strongly more important	(3,5,7)	(1/7,1/5,1/3)
Very strongly more important	(5,7,9)	(1/9,1/7,1/5)
Absolutely more important	(7,9,9)	(1/9,1/9,1/7)

**Reference:** Şengül, Ü., Eren, M., Shiraz, S.E. (2012). "Bulanık Ahp İle Belediyelerin Toplu Taşıma Araç Seçimi", *Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, Sayı: 40, 143-165.

Step 2: Criteria and sub-criteria are determined.

Step 3: Binary comparison matrices are created for criteria and sub-criteria.

$X = \{x_1, x_2, \dots, x_n\}$  is object set and  $U = \{u_1, u_2, \dots, u_m\}$ , is target set. According to Chang Extent Analysis; each object is taken for target. So that for each target, m extent analysis value is obtained (Kahraman et al., 2004).

$$M_{gi}^1, M_{gi}^2, \dots, M_{gi}^m \quad i = 1, 2, \dots, n$$

All  $M_{gi}^j$  ( $j = 1, 2, \dots, m$ ) and  $l, m, u$  are tringular fuzzy numbers. Triangular fuzzy numbers and their equivalents are shown in the table below.

Step 4: The value of fuzzy synthetic extent is defined as follows.

$$S_i = \sum_{j=1}^m M_{gi}^j \times \left[ \sum_{i=1}^n \sum_{j=1}^m M_{gi}^j \right]^{-1}$$

$$\sum_{j=1}^m M_{gi}^j = \left( \sum_{j=1}^m l_j, \sum_{j=1}^m m_j, \sum_{j=1}^m u_j \right)$$

$$\left[ \sum_{i=1}^n \sum_{j=1}^m M_{gi}^j \right]^{-1} = \left( \frac{1}{\sum_{j=1}^m u_j}, \frac{1}{\sum_{j=1}^m m_j}, \frac{1}{\sum_{j=1}^m l_j} \right)$$

$M_2 = (l_2, m_2, u_2) \geq M_1 = (l_1, m_1, u_1)$  the degree of possibility is calculated as follows.

$$V(2 \geq M_1) \left\{ \begin{array}{l} 0 \quad l_1 \geq u_2 \\ l_1 - u_2 \quad \text{other} \\ (m_2 - u_2) - (m_1 - l_1) \end{array} \right.$$

Step 5: The fuzzy numbers obtained by Chang Extended Analysis are listed using the Kwong-Bai method. After the weight vector is found according to these values, this vector is normalized.

- Kwong-Bai Method

$\tilde{A}_k = (l, m, u)$  are fuzzy numbers these numbers could be cleared by the following formula and the criteria could be listed according to the results (Kwong ve Bai, 2003). The formula used in the method is given below.

$$M(K) = \frac{l + 4m + u}{6}$$

In the application part, the results of these two methods will be compared.

Determination criteria weights of sensor location

The weights of criteria that the data sensor is to be placed, is calculated in this section. For the evaluation of the criteria, Chang Extended Analysis and then Kwong-Bai method were applied and the results were compared and interpreted.

- Chang Extent Analysis

The binary comparison matrix which is obtained by data from 10 decision makers as in Table 3.

Table 3. Binary Comparison Matrix of Main Criteria

	Price	Transportation	Popularity	Attractiveness	Information
Price	1,1,1	3,5,7	1,3,5	7,9,9	3,5,7
Transportation	1/3,1/5,1/7	1,1,1	3,5,7	5,7,9	3,5,7
Popularity	1/3,1/5,1/7	1/3,1/5,1/7	1,1,1	5,7,9	1/3,1/5,1/7
Attractiveness	1/7,1/9,1/9	1/5,1/7,1/9	1/5,1/7,1/9	1,1,1	1/3,1/5,1/7
Information	1/3,1/5,1/7	1/3,1/5,1/7	3,5,7	3,5,7	1,1,1

Step 1: The value of fuzzy synthetic extent is calculated for each criteria.

$$S_{price} = (2,13; 1,71; 1,53) * (0,012;0,016;0,023) = (0,026; 0,027; 0,035)$$

$$\begin{aligned} \text{Stransportation} &= (4,86; 6,54; 8,39) * \\ (0,012;0,016;0,023) &= (0,058; 0,104; 0,192) \\ \text{Spopularity} &= (8,20; 13,14; 20,11) * \\ (0,012;0,016;0,023) &= (0,098; 0,210; 0,462) \\ \text{Sattractiveness} &= (21,29,35) * (0,012;0,016;0,023) \\ &= (0,252; 0,464; 0,805) \\ \text{Sinformation} &= (7,66; 11,40; 15,28) * \\ (0,012;0,016;0,023) &= (0,091; 0,182; 0,351) \end{aligned}$$

Step 2: The degree of possibility is calculated according to Chang Extent Analysis.

$M2 = (l2, m2, u2) \geq M1 = (l1, m1, u1)$  the degree of possibility is calculated as follows.

$$V ( 2 \geq M1 ) \left\{ \begin{array}{l} 0 \text{ } l1 \geq u2 \\ l1 - u2 \text{ other} \\ (m2 - u2) - (m1 - l1) \end{array} \right.$$

Table 4. The degree of possibility for criteria

$V(S_i \geq S_k)$	Price	Transportation	Popularity	Attractiveness	Information
Price	-	0	0	0	0
Transportation	1	-	0,47	0	0,564
Popularity	1	1	-	0,452	1
Attractiveness	1	1	1	-	1
Information	1	1	0,9	0,259	-

Step 3: By comparing the values in each row, the minimum values are selected, and this vector, which consists of minimum values, forms the weight vector.

$$\begin{aligned} W' &= (d^*(A1), d^*(A2), \dots, d^*(An))^T \\ W' &= (0;0; 0,452; 1; 0,259)^T \end{aligned}$$

Step 4: Weight vector is normalized.  $W$  is a non-fuzzy number.

$$\begin{aligned} W &= (d(A1), d(A2), \dots, d(An))^T \\ W &= (0; 0; 0,401; 0,887; 0,229)^T \end{aligned}$$

According to Chang Extent Analysis; alternative tourism criterion was found to be the most important criteria (0.887); price (0) and transportation (0) criteria were the last in the ranking.

Kwong-Bai Method:

The Kwong-Bai values calculated for each criterion are as follows:

$$\begin{aligned} M(K_{\text{price}}) &= 0,0282 \\ M(K_{\text{transportation}}) &= 0,111 \\ M(K_{\text{popularity}}) &= 0,233 \\ M(K_{\text{attractiveness}}) &= 0,486 \\ M(K_{\text{information}}) &= 0,195 \end{aligned}$$

Step 5: The weight vector obtained by the Kwong-Bai method;

$$W' = (0,0282; 0,111; 0,233; 0,486; 0,195)^T$$

When this vector is normalized;

$$W = (0,048; 0,190; 0,399; 0,831; 0,334)^T$$

According to the results obtained; alternative tourism criterion was found to be the most important criteria (0.837); price (0,048) and transportation (0,190) criteria were the last in the ranking.

Table 5. Comparison table of vectors

Main Criteria	Chang Yöntemi	Kwong-Bai Yöntemi
Price	0	0,048
Transportation	0	0,190
Popularity	0,401	0,399
Attractiveness	0,887	0,831
Information	0,229	0,334

“Direction to tourism attractions of destination (Gastro, entertainment, nature, etc.) (Attractiveness)” has determined as the most important criteria according to both Chang extended analysis and Kwong-Bai methods among the five main criteria in the hierarchy. Firstly, it seems that tourists’ usually cares experience dimension of attractiveness and maximize their benefits during their trip. Within this scope, it will be possible to gather the maximum and necessary information with placement of data sensors by analysing attractiveness and potentials of the destination. Also, it has to be important to decide which destination’s attractiveness will be come to fore for visitors. “Guide to popular touristic destination (Popularity)” is the second priority criteria as an expected. Popularity can affect from many different reason such as the cultural/natural importance of destination or social media

references, so they have to be analysed carefully, too. In order, “Providing information on visited attractions (Information)” is third, “Information about regional transportation (Transportation)” is fourth and last one is the “Price Advantage (Price)” criteria. It is interesting that, price and transformation criteria are not determined as important with other. The main reason of this result is possible to have easy access to transportation information by internet. Also if you are travelling, price will have the less importance. However, all of the criteria have to be integrated effectively to create a successful smart tourism location.

### Conclusion and recommendations

Turkey has a great tourism potential such as historical, cultural and natural features. However, competition in tourism is becoming more intense. Therefore, it is important to implement sustainable tourism policies in today's economic environment. In this context, local attractiveness has become a priority to create economic value for regional economies.

Recently, tourism activities which are counted as one of the sub-sectors of services, have been improving continuously with the change of social life conditions and the development of technology. Like many other issues, the use of mobile devices has also affected the attitudes and behaviours of tourists. As the tourism sector became internet based, tourism activities driven by information technologies have been moved to a new dimension, thus the tourism sector has entered into a transformation process. Digital technologies are changing the tourism's operation processes from beginning to end through ICT. Smart tourism implementations start by digital tourism, but increase the attractiveness of the locations by gathering data of tourist behaviours and diversify the experiences of tourists by offering service suggestions for tourists.

The aim of this study is determining the criteria for data collection points in order to investigate the attitudes and behaviours of tourists and citizens in the perspective of smart cities. The attractiveness data gathered with the applications of smart tourism provide opportunities for determining tourism policies of locations and carrying on investment plans sturdily. This study lists the importance level of the attractiveness criteria for the sample and reveals the characteristics of the points where the data sensors should be placed. It has been seen that “Direction to tourism attractions of

destinations (gastro, entertainment, nature etc.) (attractiveness)” and “guide to popular tourist destination (popularity)” criteria are the main expectations for the sensor placement point in attractiveness preferences of consumers. There will be lots of attractiveness in many destinations and to introduce all of them will be high cost of money and time. Policy makers have to analyse the reasons and which destination attractiveness will come to fore to visitors. Although, popularity can be affected from many reasons such as cultural/natural importance of destination or social media references, policy makers have to care how to analyse the differences of attractiveness for the sustainability of tourism policies. It can be said, if any attractiveness has differed itself or becoming popular, then tourists prefer at first, and they do not care its value or transportation problem. Also all of the criteria are correlated each other and they have to be integrated to manage destination attractiveness according to their importance.

Effective presentations of the tourist attractions towards the target audience are vital for the success of tourism services. Smart tourism applications will be able to realize the success, by transforming collected data of tourist behaviours around the specified locations into information. In the placement of sensors, determination of prior points for tourists will make a significant contribution to understanding of existing tourist structure, analyzing of the tourists' trends and generating value added. With the evaluation of the findings to be obtained, more efficient use of local tourist attractions and investments towards attractiveness will be managed effectively. Optimizing these targets will be possible by gathering and analysing the data from the right points. These criteria are the clues to manage destination and using smart tools will support the awareness of destination attractiveness. Smart applications that increase the service experience in tourism can be offered important opportunities. In this context, it is recommended that smart tourism investments which are important for tourism investments should be included in regional development plans quickly.

In this study, sample is selected from domestic tourists, and this is the main limitation of the study. The enrichment of the sample with foreign tourists and creating a new sample will be a good suggestion for smart tourism studies. It is also important to examine tourism destinations to be created by selecting the appropriate points for the attractiveness characteristics determined

for new studies. This study is a pilot study for determining the criteria of data sensors' locations. Next studies will be examined of using data sensors for specified tourism destinations and evaluate the results of smart tourism implementations. It is also be useful for enlarging the data and comparing them. Furthermore, the use of multi-criteria decision making methods is recommended to practitioners for later studies.

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