MAKÜ İİBFD

Journal of Mehmet Akif Ersoy University
Economics and Administrative Science Faculty

Volume: 12

Issue: 2

June, 2025

e-ISSN: 2149 - 1658

June, 2025 **e-ISSN: 2149-1658**

MAKÜ İİBFD

Journal of Mehmet Akif Ersoy University
Economics and Administrative Science Faculty

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MAKÜ | Journal of Mehmet Akif Ersoy University
Economics and Administrative Sciences Faculty

e-ISSN: 2149-1658
Volume: 12 / Issue: 2
June, 2025
pp.: 605-626

Evaluation of Service Quality with SERVQUAL-ENTROPY Integrated Method: Application of Eskisehir Metropolitan Municipality *

Kürşad Emrah YILDIRIM[1], Murat ERCAN[2], Sami ÖZCAN[3], Eser GEMİCİ[4], Serra Namlu ÇAMLIBEL[5]

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* This study was prepared using the data obtained from the project numbered SBA-2024-2424 supported by Anadolu University Scientific Research Projects Coordination Unit.

https://doi.org/10.30798/makuiibf.1593387

Abstract

This study aims to measure the quality of public services provided by Eskişehir Metropolitan Municipality by using the SERVQUAL measurement model and the Entropy method together. The study examines citizens' perceptions of the services provided by Eskişehir Metropolitan Municipality and supports the results by analyzing the extent to which citizens' expectations are met and the difference between expectations and perceptions in terms of service quality using the Entropy method. An integrated approach provides certainty in identifying strategic priority areas for the municipality. The research surveyed 1,158 citizens who received services from Eskişehir Metropolitan Municipality. The results show that most of the quality deficiencies are related to parking, transport, traffic, regulations and resource use. The study combines subjective perception with data-driven analysis. It thus contributes to the literature with a hybrid methodology that increases the robustness of municipal service evaluations. The study aims to provide strategic recommendations to improve the quality of municipal services and increase citizen satisfaction.

Keywords: Service Quality, Metropolitan Municipality, Servqual, MCDM, Entropy.

Article Type	Application Date	Admission Date
Research Article	November 29, 2024	June 3, 2025

To cite this article: Yıldırım, K. E., Ercan, M., Özcan, S., Gemici, E., and Çamlıbel, S. N. (2025). Evaluation of service quality with SERVQUAL-ENTROPY integrated method: Application of Eskisehir Metropolitan Municipality. *Journal of Mehmet Akif Ersoy University Economics and Administrative Sciences Faculty*, *12*(2), 605-626. https://doi.org/10.30798/makuiibf.1593387

1. INTRODUCTION

Public services are services provided by public institutions, especially local governments, and developed to meet the expectations of citizens. Determining the expectations of citizens and meeting these expectations leads to the perception of the quality of services. In this study, SERVQUAL measurement model and Entropy method were used together to measure the quality of the services provided by Eskişehir Metropolitan Municipality and the results were evaluated. SERVQUAL measurement model, which is one of the measurement models frequently used in the measurement of service quality, measures the expectations about the services provided and the extent to which these expectations can be met, that is, the perception formed. However, this measurement model has been criticized for evaluating expectations and perceptions only through arithmetic averages. In order to eliminate this limitation in the study, a more objective weighting approach has been put forward by preferring to use the Entropy method together with the SERVQUAL measurement model. Thus, the findings related to service quality were evaluated on a more reliable basis.

When the findings obtained as a result of the analyses are examined, it is seen that there are significant differences between expectations and perceptions about municipal services. It has been observed that the expectations of citizens especially on issues such as car parking, public transport and transportation cannot be met. Apart from this, it has been determined that the quality is low in terms of being effective in the use of resources, fulfilling the promises made and making efforts to solve existing problems. The use of the Entropy method together with the SERVQUAL measurement model in determining these problems contributed to the correct determination of the sources of the heterogeneity of the Service Quality Scores (SQS) calculated with perception and expectation scores. Thus, it has contributed to providing important information on which strategic priorities will be chosen. It has been determined that it is important for the municipality to pay attention to issues such as strengthening transport and infrastructure services, planning resources and services more effectively and efficiently, and fulfilling the promises made to the citizens about the services on time.

The SERVQUAL model evaluates the difference between respondents' expectations and perceptions only through arithmetic averages, ignoring the heterogeneity of the data. In this study, the entropy method was integrated into the SERVQUAL model to measure the diversity of information and inconsistencies in the participants' responses. This made the measurements more objective and robust. The studies conducted in Türkiye to measure the service quality of local governments generally use the adapted version of the SERVQUAL scale for local governments or other conventional satisfaction surveys. This study differs from others in that it is integrated with multicriteria decision-making (MCDM) techniques and provides data-based solutions. As such, it provides practitioners with a new perspective on strategic planning. In the literature, there is a limited number of studies that use the entropy method to evaluate the quality of public services. From this point of view, the study is one of

the rare examples demonstrating the applicability of the entropy method in the public sector. The study, which will contribute to the literature in this area, is a methodological reference for future research.

2. QUALITY CONCEPT

The concept of quality is a concept that has emerged as a result of humankind's desire always to reach the better and has been shaped by the concept of "excellence". Since quality, just like excellence, is relative and subjective, it can be interpreted differently depending on the perception of the person. For this reason, it is difficult to make a clear definition of the concept. The level of fulfilment of the expectation expresses the perception of quality shaped by expectation. The first historical record of this expectation, which is thought to have emerged with the existence of human beings and the concept of quality, which is the result, is the Code of Hammurabi. In the laws written in 2000 BC, it was stated that the master builder would be responsible for the problems that would arise in the buildings of the period and would be punished (Şale, 2004). Similarly, the fact that the Romans built their buildings in accordance with certain specifications reflects the understanding of quality at that time. Quality, which we encounter in many historical records in the past, started to gain its current meaning after the Industrial Revolution. In this period, organizations established quality control units in order to strictly control the goods they produce (Şimşek, 2002). Quality, which is one of the most important factors influencing customer satisfaction (Ab. Karim et al., 2025), is a concept that indicates the extent to which a product or service meets specified needs and expectations (Singharia & Gupta, 2025). The efficiency and effectiveness studies of Taylor and Fayol, the pioneers of the classical management approach, are considered to be the first systematic analyses on quality. In the same period, issues such as "suitability for use and suitability for purpose", which were discussed by researchers such as Deming and Juran, made significant contributions to the development of the concept (Koç, 2017). The concept of quality, which was defined only in terms of products, became important in the service sector in the 1990s with the acceleration of the service sector, and quality service delivery has become the key to success and sustainability for organizations today (Usta & Memiş, 2009).

3. DEFINITION OF SERVICE CONCEPT

Basic needs, which constitute the essence of people's needs, are met by both private and public institutions. The concept of service, which is an important element for ensuring the continuity of life and increasing its quality, is a concrete concept. It consists of activities such as entertainment, health and comfort, which require immediate consumption when the concept, which expresses some spiritual pleasures, is produced (Quinn et al., 1987). Since service is a comprehensive concept, many different definitions have been made. When these definitions are analyzed, it is seen that the concept has a complex and multidimensional structure. Despite all this diversity, the concept of service can be defined as a set of actions that develop between an organization and a needy person (customer), have an economic value and provide benefit and pleasure to the recipient (Evans & Lindsay, 1999; Murdick, 1990). In addition to this definition, it should be noted that services consist of activities used in solving

problems related to human life (Yücel et al., 2012). Therefore, services are intangible products produced to meet the expectations of customers (Neal et al., 1994). The intangibility of services makes it difficult for the producer to understand to what extent the expectations of those who consume them are met and what kind of perception the consumption creates in the customer. This difference between expectation and perception is an important issue to be emphasized in terms of service quality (Parasuraman et al., 1985).

One of the reasons why a customer's perception of a service is negative is that the difference between the organizational strategic intention and the customer expectation and the need for this expectation is high. Therefore, in order to avoid this difference, correct evaluations should be made while answering the what and how questions asked in service design (Goldstein et al. 2002). How the activities related to the service provided in the service delivery process are perceived by the service receivers and to what extent their expectations are met before the service process is an important component in determining the service quality. Increasing expectations of customers and consumers becoming more conscious increase the importance of the concept of service quality (Kayral, 2015).

Services are realized to meet a need. Therefore, maturing a service is a time-consuming and challenging process. The difficulties of service design arise from various factors such as (1) effective design problems arising from the inviolable nature of services, (2) difficulties in imitating and protecting the service, (3) difficulties in determining quality and value due to the lack of trial opportunities, (4) difficulties in balancing customer satisfaction and organizational efficiency (Zeithaml et al., 2009).

4. SERVICE QUALITY

The concept of service quality, which is one of the concepts that has attracted significant attention both in academic literature and in practice since the 1990s, has risen to an important position with the internationalization of services (Öztürk, 2016). For service organizations, service quality has become a concept related to strategic goals such as gaining/increasing market share, profit, productivity, customer loyalty/loyalty and competitive advantage (Kayral, 2015). Unlike physical products that are consumed after production, services are first sold and then produced. Consumption takes place at the same time as production. Therefore, the quality of the service cannot be controlled before sales (Zeithaml et al., 1985). Service quality plays a crucial role in the evaluation of services, which, unlike tangible products, have characteristics such as intangibility, simultaneity, variability and absence (Palamidovska-Sterjadovska et al., 2024). Service quality should be seen as a concept that is not only result-oriented but should be considered as a satisfaction measure that covers all processes of service delivery (Ab. Karim et al., 2025). In order to increase the quality of services, it is necessary to define the concept correctly and make it measurable. When the definitions related to service quality are analyzed, it is seen that two basic elements come to the fore. These are customer expectations and customer perception/satisfaction (Özer & Önen, 2016). The difference between these two basic elements

refers to quality. However, determining an acceptable quality can often show personal differences. It has been determined that these differences, which are shaped according to individual standards, are generally related to the fact that the service cannot be provided professionally and that it is presented with a personal approach instead of an objective presentation (Garvin & Quality, 1984). Therefore, it is challenging to ensure continuous quality in services that come to life with individual performance. The intangible nature of the service and the variability of the personal emotional states of both the service provider and the service recipient create difficulties in the continuity of service quality (Öztürk, 2016). As can be understood from all these, the most important factor determining the quality of a service is human. Considering that both parties in service delivery are human, it is seen that service quality emerges with the interaction of the parties. The obvious influencer of this interaction is the party providing the service. It is challenging to control the performance of the personnel providing a service (Zeithaml et al., 1988).

Three basic characteristics determine service quality. These characteristics, each of which is derived from a different aspect of the service, are as follows (Pérez et al., 2007); (1) since services are consumed immediately after they are produced, service consumers can perceive all defects related to the quality of the service, (2) the main determinant of service quality is the interaction between the service provider and the service receiver, (3) customers' previous experiences play an important role in determining service quality.

Service quality, which is an abstract and variable concept, is the rate of transformation of customer expectation into perception. Customers' expectations are shaped mainly by experiences, information obtained from other sources and the image of the organization in terms of service (Sütütemiz, 2015). Accordingly, customers who make evaluations pay attention to how the service is finalized, the way the service is provided, and who provides the service. They evaluate what they get as a result of the service, how they act while obtaining it, and the image of the service provider (Koç, 2017). It is possible to say that the expectations of customers have become much more differentiated in recent years. Especially with the effect of social media, experience sharing has increased and these shares have shaped organizational images. Therefore, one of the important determinants of service quality in recent years is the widespread use of technology and social media.

Service quality has two important components. These components are the quality of the service and the quality of the presentation (Esin, 2004). There are many skills and features within these two components. If the organization develops these, it increases the service quality. The capabilities and features of these two components are speed, price, flexibility, innovation, trust, communication, etc. and their development will increase customer satisfaction and thus the quality of service (Acuner & Şebnem, 2001).

The quality of a service can be revealed by the difference between the customer's expected satisfaction and perceived satisfaction. Both expectation and perception may result in different evaluations in the same situations. For example, the expectation of a person who goes to a hospital to receive health services for routine controls will be different from the expectation of the hospital he/she goes to as a result of an emergency case. Another reason for the difference between expectation and perception is the service itself. The unexpectedness of the way the service emerges, the fact that it cannot be compared with other services, and whether the customer is involved in the service process are the factors that arise from the essence of the service and cause differences in its evaluation (İslamoğlu & Aydın, 2016). Managers have important duties in increasing service quality and transforming it into an understanding that spreads throughout the organization. Managers who adopt the understanding of quality are generally (1) able to explain the aims of the understanding of quality to the whole organization, (2) increase organizational commitment by motivating employees to achieve organizational goals, (3) impose obligations as well as responsibilities on employees in ensuring quality, (4) set an example for the organization by fulfilling their duties and responsibilities in terms of quality, (5) know that there are no limits in terms of quality, (6) follow customer feedbacks about the services provided and evaluate them (Uraltaş & Ekici, 2013).

The concept of service quality has evolved over time. It is no longer just about customer satisfaction but has become a concept related to multidimensional elements such as digitalization, process quality, physical and technical equipment, security and personalization (Walke & Winkler, 2024). Recent studies on service quality show that the dimensions of service quality have changed with the spread of digitalization and technological services. It is emphasized that in sectors such as banking, where digitalization is intensively used, elements such as system quality, information quality and user experience have emerged as dimensions that directly affect service quality (Palamidovska-Sterjadovska et al., 2024; Deng, Liu & Liu, 2023).

The concept of service quality is a concept that has different meanings from different perspectives. While customers make evaluations according to the degree to which their expectations are met in service quality, they make evaluations from the perspective of establishing service standards for organizations and carrying out activities based on them. For public administration, the concept of quality is related to the quality of life to be increased and more effective services such as education, health and transport (Örs, 2007). In order to measure the quality of public services, it is not enough to fulfil the expectations from the service alone because there are different determinants such as different needs, different priorities, correct use of resources, equality, impartiality and accountability in public services (Galloway, 1998).

5. SERVICE QUALITY IN LOCAL GOVERNMENTS

Local services, in common parlance, municipal services are a showcase of general public services. Therefore, it is necessary to maintain the satisfaction levels of citizens who benefit from the service (Usta & Memiş, 2010). Today, with the changing dynamics, a citizen-oriented approach has been adopted in public services. Citizens not only accept the services offered to them but also participate actively in the processes of determining, preparing and providing these services (Çetinkaya et al., 2016).

When the performance management process, which focuses on the effectiveness and efficiency of municipal services, is considered, the fact that one of the performance criteria is citizen satisfaction and that citizen satisfaction can be achieved through the provision of quality services is an important point (Boyne, 2002). With this approach, it becomes possible both to use resources more efficiently in the services provided by municipalities and to provide services that are more appropriate to the needs of citizens.

With the new understanding of public administration, the concept of quality is defined as the quality of the services provided to meet the needs of citizens and the provision of these services through the units closest to the citizens. This understanding has placed an important responsibility on municipalities in terms of quality and made it obligatory for them to provide quality services. In the services provided by municipalities; (1) it has become an obligation to take into account the changing social expectations and pressures and to provide quality services, (2) if the services are of high quality, the awareness and recognition of the municipality increases, (3) providing quality services contributes to solidarity and rapprochement by increasing trust and support for the municipality (Gaster, 1996).

However, today's rapid change, social and environmental problems make it difficult for municipalities to understand and fulfil citizen expectations. In addition, various legal regulations and scarce resources are recognized as important problems that slow down the efforts of municipalities to improve the quality of services (Kurgun et al., 2008). For this reason, local governments are struggling to fulfil these activities with limited resources while endeavoring to provide quality services with external pressures on the one hand. This dilemma forces local governments to put forward innovative approaches to use resources more efficiently and access new resources.

There are various factors affecting the quality of local services and citizen satisfaction. These factors include; (1) previous service experiences of citizens, (2) demographic characteristics such as age, gender, occupation, and education level, (3) communication level of local governments with citizens, (4) technological infrastructure used in service provision, (5) correct and efficient use of resources, (6) the rate of reflection of citizen expectations on service policies, (7) acting in accordance with the principle of equality in service provision, and (8) the thoughts that service providers are/are not in a relationship of interest with third parties (Sevimli, 2006; Adaman & Çarkoğlu, 2000; Akyıldız, 2012).

6. SERVICE QUALITY MEASUREMENT MODELS

It is very difficult to define and measure the concept of service quality, which is formed by the combination of abstract concepts such as service and quality, which may differ according to the person. The difficulty of determining different expectations and meeting them with a single service makes it difficult to measure quality. Despite all these difficulties, service quality is an indispensable element for the success of organizations providing services. The essentiality of measuring this element has led to the development of many models to measure service quality. When these models are analyzed, it is seen that the basic elements are; (1) being market-oriented, (2) being customer-oriented, (3) motivating employees for service delivery, (4) determining the factors that affect service quality positively/negatively, (5) performing measurements accurately and effectively, (6) receiving feedback from customers, (7) ensuring efficiency and continuity in customer relations (Seth et al., 2005).

The number of models developed to determine the level of service quality based on these fundamental elements is quite high. These models include Kano model, gap/difference model, three-dimensional service quality model, performance model, IT adaptation model, hierarchical approach service quality model, electronic service quality model. In this section, the Gap/Difference Model (SERVQUAL), which forms the basis of the study and is one of the frequently used methods in service quality measurement, will be emphasized.

The SERVQUAL model developed by Parasuraman et al. (1988) is a model that focuses on identifying and analyzing gaps/differences in service quality. The model measures the differences between customers' service expectations and their perceptions after the service. It focuses on five basic dimensions. These dimensions are reliability, assurance, tangible/physical elements, empathy and responsiveness. The scale provides valid and reliable solutions to service organizations and can be applied in many service areas (Parasuraman et al., 1988). A major advantage of SERVQUAL is that it can determine customer expectations. Thus, service quality can be determined by comparing expectations with post-service perceptions (Asubonteng et al., 1996).

SERVQUAL is a common quality measurement model used to measure service quality in many different sectors (banking, education, health, transport, etc.) (Zhang & Song, 2024). According to some researchers, taking the difference between expectation and perception with the SERVQUAL scale is seen as a disadvantage. The basis of the criticism is that difference scores may create statistical problems in validity and reliability analyses (Brown et al., 1993). Parasuraman et al. (1994), responded to the criticisms by stating that expectations and perceptions can be re-evaluated over time and changes can be monitored (Parasuraman et al., 1994). Another criticism about the scale is that the SERVQUAL scale is not suitable for all service organizations. The criticisms are that the five dimensions determined for the scale do not address every type of service. Especially in organizations offering multiple services, the difficulties of making measurements for each service have been pointed out (Carman, 1990). Another criticism about the dimensions is that the results obtained are abstract because the dimensions are not

concrete. This intangibility may make it difficult to identify specific deficiencies in service delivery clearly. For example, the scale may reveal that the behavior of the service personnel is perceived as negative, but it cannot determine which behavior leads to this negative perception, thus making it difficult to take corrective steps (Öztürk, 2000).

Despite all these criticisms, the SERVQUAL scale is valuable in that it can be applied among both old and new customers, changes in customer expectations can be monitored and organizations have the opportunity to improve service quality accordingly. Moreover, since the cost of application is low, it facilitates comparison with other organizations (Asubonteng et al., 1996).

7. SCOPE AND DATA

One of the most frequently used and accepted scales in service quality measurement is the SERVQUAL scale. Although it has been widely used since it was introduced to the literature, some criticisms have been brought to the scale. One of the parts where these criticisms are concentrated is service quality scoring. Service quality scoring is calculated by the difference between the average expectation value and the average perception value. This calculation is performed separately for each item in the scale. The quality is evaluated by taking into account the negative and large size of the score obtained. In the evaluation made by Babakus and Boller (1992) on this scoring and evaluation, they stated that when participants are asked to report the level of expectation and perception to measure service quality, the difference between expectation and perception may become suspicious due to some psychological pressures. Similarly, Teas (1994) argued that the difference between expectation and perception is based on people's experiences and therefore the difference between expectation and perception is not clear. In parallel, Buttle (1996) emphasized the inadequacy of taking the difference between these two values in the calculation of expected and perceived service quality. Souca (2011) argued that the measurement of the expectation part of the SERVQUAL scale is difficult. Therefore the results obtained in the calculation of the service quality score may not be reliable enough. Therefore, it is seen as a strong possibility that various problems may occur during the conversion of participants' thoughts and criticisms into scores in the SERVQUAL scale (Tsaur et al., 2002). Taking these criticisms into consideration, Augustyn and Seakhoa-King (2005) stated that the quality results obtained as a result of service quality measurement with the SERVQUAL scale will not fully reflect the perception of quality, and that different tools should be used to measure quality adequately / clearly.

When the literature is examined, it is seen that there has been an increase in the studies in which SERVQUAL scale and Multicriteria Decision Making (MCDM) techniques have been used together, especially in recent years. Lee and Kim (2012) Data Envelopment Analysis (DEA), Stević et al. (2021) The Delphi and Full Consistency Method (FUCOM), Adebiyi et al. (2022) Fuzzy Analytical Hierarchy Process (FAHP) and VIKOR, Xie et al. (2022) Decision Making Trial and Evaluation Laboratory

(DEMATEL), Al Awadh (2023) Analytical Hierarchy Process (AHP) techniques and SERQUAL model. There is a common opinion that the results obtained in the studies are more reliable.

In the light of this information, the study aims to evaluate the service quality scores obtained by SERVQUAL technique together with the results of Entropy method, which is one of the objective weighting methods among MCDM methods, and to measure the quality measurement more clearly and easily. For this purpose, SERVQUAL scale was applied to citizens living in Eskişehir and benefiting from municipal services. The sample volume required for the application was calculated with the help of equation (1) below.

$$n = \frac{N \cdot p \cdot (1-p)}{(N-1) \cdot \left(\frac{d}{z_{1-\alpha/2}}\right)^2 + p \cdot (1-p)} \quad (1)$$

Here n, sample size; N, the population size; z, the table value of the confidence level (such as 1.64; 1.96; 2.57); p, the probability of the examined event occurring; $1-p$, the probability of the examined event not occurring, and d whereas the tolerance level (0.05 or 0.01). Accordingly, when the tolerance level is 0.05, the minimum sample size required for the study is calculated as follows.

$$n = \frac{696060 \cdot 0.5 \cdot (1-0.5)}{(688989-1) \cdot \left(\frac{0.05}{1.96}\right)^2 + 0.5 \cdot (1-0.5)} \cong 384$$

The calculation was made by taking into account the number of voters in the General Election of Local Authorities held on 31 March 2024 in Eskişehir, which was determined as the main population. It was concluded that at least 384 participants should be surveyed within the scope of the study. As a result of the fieldwork, accurate and complete returns were obtained from a total of 1,158 participants. Therefore, it is possible to say that the number of participants participating in the study represents the main population quite well. In determining the participants, convenience sampling method was used.

8. METHODOLOGY

In the study, it is aimed to evaluate SERVQUAL service quality scores (SQS) and the weights obtained by Entropy method together. In this section, brief information about Entropy, one of the MCDM methods, is given.

8.1. Entropy Method

Entropy weighting is a method that eliminates the intervention of decision makers in criterion weightings since it determines criterion weights without subjective approaches of decision makers. Entropy weighting is a multicriteria decision-making method used to determine the weight of a decision criterion by relating the weighting of a criterion directly to the information of that criterion (Bazzazi, et al., 2011). In order to determine the objective weights by entropy method, each criterion in the decision matrix in equation (2) should be normalized as follows (Deng, Yeh, & Willis, 2000):

$$p_{ij} = \frac{x_{ij}}{\sum_{p=1}^{n} p_{ij}} \qquad i = 1, 2, \ldots\ldots, n;\ j = 1, 2, \ldots\ldots, m \tag{2}$$

As a result of the operations in Equation (2), a normalized decision matrix representing the relative performance of the alternatives is obtained as follows.

$$P = \begin{bmatrix} p_{11} & p_{12} & \cdots & p_{1j} \\ p_{21} & p_{22} & \cdots & p_{2j} \\ \cdots & \cdots & \cdots & \cdots \\ p_{i1} & p_{i2} & \cdots & p_{ij} \end{bmatrix} \tag{3}$$

In the light of the information contained in the normalized decision matrix in Equation (3), entropy values for each criterion (e_j) is calculated by means of equation (4).

$$e_j = -k \sum_{i=1}^{n} p_{ij} ln p_{ij} \tag{4}$$

In Equation (4) $k = {}^{1}/_{\ln(n)}$ expression $0 \leq e_j \leq 1$ means a constant that satisfies the condition. The degree of divergence of the average information contained in each criterion (d_j) can be calculated as follows:

$$d_j = 1 - e_j \tag{5}$$

The distance between the alternative scores for the criteria, calculated in equation (5) d_j has a structure directly proportional to its values. This means that d_j As the value increases, the distance between the scores of the alternatives and accordingly the uncertainty increases. In the entropy method, criterion weights are calculated at the last stage. This calculation is made as in equation (6).

$$w_j = \frac{1 - e_j}{\sum_{i=1}^{n} 1 - e_j} \tag{6}$$

In equation (6) above w_j, shows the weight values, which are the indicators of the importance levels of the criteria. It should be noted here that all w_j of the sum of the values ($w_1 + w_2 + \ldots\ldots + w_n$) is equal to 1.

9. FINDINGS

As a result of the reliability analysis performed on the data of the study with the SPSS program, it was seen that the study was 98% reliable. Therefore, it is concluded that the scale applied on the determined sample indicates high reliability. During the reliability analysis, all of the statements in the scale were taken into consideration. In other words, both the statements related to expectation and the statements related to perception were evaluated.

9.1. Descriptive Findings

The presentation of the findings started with the demographic characteristics of the participants. 57.3% of the participants were male and 42.7% were female. In the city, which has a young population, the age group with the highest rate of participation was citizens between the ages of 18-25 with a rate of 25%. When the educational status of the participants is analyzed, it is seen that high school and undergraduate graduates are in the majority. When the occupational distribution is analyzed, it is determined that self-employed people are in the first place and public employees are in the second place. 52% of the participants reside in Tepebaşı district and 48% in Odunpazarı district.

Table 1. Descriptive Results

Feature	Category	Number of People	Per cent
Gender	Woman	495	42.7
	Male	663	57.3
Age	18-25 years old	290	25.0
	26-30 years old	128	11.1
	31-35 years old	102	8.8
	36-40 years old	128	11.1
	41-45 years	120	10.4
	46-50 years old	133	11.5
	51-55 years	108	9.3
	56-60 years	92	7.9
	61-65 years	23	2.0
	66 years and over	34	2.9
Education Status	Primary School	65	5.6
	Middle School	74	6.4
	High School	399	34.5
	Associate degree	176	15.2
	Licence	353	30.5
	MA/PhD	91	7.9
Employment Status	Public Sector	284	24.5
	Private Sector	185	16.0
	Self-employment	308	26.6
	Student	136	11.7
	Pensioner	138	11.9
	Other	107	9.2
Income Status	10,000 TL and below	242	20.9
	Between 10,001 TL-20,000 TL	265	22.9
	20,001 TL-35,000 TL	339	29.3
	35,001 TL-50,000 TL	211	18.2
	50,001 TL-75,000 TL	69	6.0
	75,001 TL and above	32	2.8
Physical Disability Status	Yes	33	2.8
	No	1,125	97.2
District of Residence	Tepebasi	602	52.0
	Odunpazari	556	48.0

9.2. Findings Related to Service Quality

In this section, in addition to the expectation and perception averages for all items in the scale, the AQS, entropy weights of the participants' expectations and entropy weights of the participants'

perceptions were calculated. All calculations were performed with the help of MS Excel. The findings obtained are presented in Table 2.

Table 2. SQS and Entropy Weights

Question No	Question	Expectation Average	Current Situation Average	SQS	Expectation Weights	Perception Weights
1	The Municipality has modern working environments, modern tools and equipment.	4.05	2.87	-1.1805	0.03910	0.02815
2	Municipality employees are clean and neat in appearance.	4.21	3.14	-1.0708	0.02708	0.02364
3	The municipality fulfils its promises on time.	4.16	2.44	-1.7237	0.04020	0.03646
4	The municipality endeavors to solve the problems of the people.	4.26	2.58	-1.6831	0.03580	0.03477
5	The municipality serves the first time and right.	4.19	2.58	-1.6071	0.03408	0.03233
6	The public is sufficiently informed about the municipality's activities.	4.20	2.65	-1.5449	0.03494	0.03262
7	The municipality keeps careful records of the work done.	4.26	2.87	-1.3912	0.02951	0.02459
8	Municipality employees have sufficient knowledge and skills and are willing to help citizens.	4.29	2.77	-1.5173	0.02823	0.02993
9	Municipality staff inspire confidence in the public and are respectful towards the public.	4.32	2.85	-1.4724	0.02780	0.03004
10	The municipality takes care of every citizen and treats them fairly.	4.29	2.56	-1.7314	0.03179	0.03413
11	The working hours of the municipality are determined in accordance with the citizens.	4.25	2.98	-1.2660	0.02949	0.02823
12	The municipality pays due attention to environmental and cleaning services.	4.32	2.81	-1.5095	0.02987	0.03329
13	The time and conditions under which cleaning services are provided are appropriate.	4.25	2.93	-1.3178	0.03011	0.02952
14	The municipality pays enough attention to the inspection services necessary for the citizens.	4.24	2.69	-1.5518	0.03213	0.03203
15	The manner in which the Municipality carries out its audit activities is appropriate and correct.	4.21	2.71	-1.5069	0.03244	0.03181

(Table 2 cont.)

Question No	Question	Expectation Average	Current Situation Average	SQS	Expectation Weights	Perception Weights
16	It is easy to reach the person or unit to whom complaints about the municipality will be forwarded.	4.29	2.71	-1.5786	0.03081	0.03299
17	The municipality takes complaints seriously and evaluates them.	4.32	2.65	-1.6684	0.03002	0.03377
18	The Municipality resolves complaints in an appropriate time.	4.27	2.58	-1.6952	0.03225	0.03443
19	Zoning services are carried out in accordance with the law and fairly.	4.28	2.55	-1.7332	0.03280	0.03466
20	The municipality's zoning services are sufficient to meet the needs.	4.22	2.49	-1.7297	0.03505	0.03550
21	The municipality will not allow any construction that will spoil the appearance of the city.	4.31	2.67	-1.6468	0.03054	0.03642
22	Municipality is in cooperation with relevant institutions in infrastructure works.	4.26	2.58	-1.6788	0.03232	0.03517
23	The number of public transport vehicles and their routes and stops are sufficient.	4.22	2.42	-1.8005	0.03696	0.03854
24	The municipality deals with the car parking problem and seeeks to resolve this problem.	4.23	2.22	-2.0026	0.03943	0.04280
25	The Municipality shall organize a sufficient number of useful social and cultural activities.	4.24	2.95	-1.2953	0.03249	0.03221
26	Municipality organizes activities such as panels, seminars, theatre, concerts for the public.	4.26	3.17	-1.0889	0.03108	0.02752
27	The municipality endeavors to facilitate student life.	4.30	2.83	-1.4646	0.03071	0.03202
28	The municipality takes care to meet the vital needs of the elderly and infirm.	4.29	2.92	-1.3748	0.03059	0.02973
29	The municipality contributes to the promotion of the city through its activities.	4.31	3.15	-1.1598	0.02854	0.02761
30	The resources of the municipality are sufficient.	4.26	2.85	-1.4111	0.03090	0.02938
31	Uses municipal resources effectively and efficiently.	4.29	2.57	-1.7150	0.03293	0.03570

The weights of AQS, weights of expectations and weights of perception were calculated separately and summarized in Table 2. The calculated entropy weights provide information about the heterogeneity or homogeneity of the answers given to the related item. Higher entropy weights indicate that there is heterogeneity in the answers given to the related item, while lower weights indicate that the answers are relatively more homogeneous. When determining the source of heterogeneity, it is seen that this situation is shaped in accordance with the nature of "expectation" and "perception" situations. While heterogeneities in expectation weights are realized on values smaller than the average by nature, heterogeneity in perception weights is concentrated on values larger than the average. In order to make the comparisons more understandable for the purpose of the study, the rankings of all questions in terms of AQS and weights are as shown in Table 3.

Table 3. Ranking of Items According to SQS and Entropy Weights

Question No	Question	Ranking According to SQS	Ranking According to Expectation Weights	Ranking According to Perception Weights
1	The Municipality has modern working environments, modern tools and equipment.	28	3	27
2	Municipality employees are clean and neat in appearance.	31	31	31
3	The municipality fulfils its promises on time.	6	1	3
4	The municipality endeavours to solve the problems of the people.	9	5	8
5	The municipality serves the first time and right.	13	8	16
6	The public is sufficiently informed about the municipality's activities.	16	7	15
7	The municipality keeps careful records of the work done.	23	26	30
8	Municipality employees have sufficient knowledge and skills and are willing to help citizens.	17	29	22
9	Municipality staff inspire confidence in the public and are respectful towards the public.	20	30	21
10	The municipality takes care of every citizen and treats them fairly.	4	16	11
11	The working hours of the municipality are determined in accordance with the citizens.	27	27	26
12	The municipality pays due attention to environmental and cleaning services.	18	25	13
13	The time and conditions under which cleaning services are provided are appropriate.	25	23	24

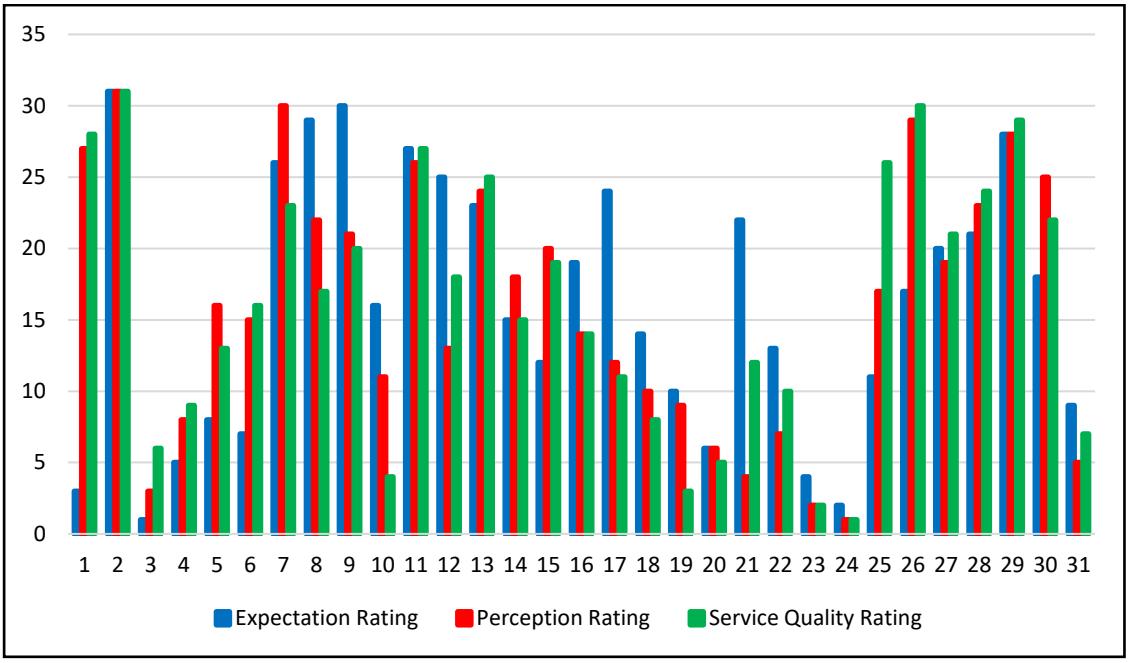
(Table 3 cont.)

Question No	Question	Ranking According to SQS	Ranking According to Expectation Weights	Ranking According to Perception Weights
14	The municipality pays enough attention to the inspection services necessary for the citizens.	15	15	18
15	The manner in which the Municipality carries out its audit activities is appropriate and correct.	19	12	20
16	It is easy to reach the person or unit to whom complaints about the municipality will be forwarded.	14	19	14
17	The municipality takes complaints seriously and evaluates them.	11	24	12
18	The Municipality resolves complaints in an appropriate time.	8	14	10
19	Zoning services are carried out in accordance with the law and fairly.	3	10	9
20	Municipality's zoning services are sufficient to meet the needs.	5	6	6
21	The municipality will not allow any construction that will spoil the appearance of the city.	12	22	4
22	Municipality is in cooperation with relevant institutions in infrastructure works.	10	13	7
23	The number of public transport vehicles and their routes and stops are sufficient.	2	4	2
24	The municipality deals with the car parking problem and seeks to resolve this problem.	1	2	1
25	The Municipality shall organise a sufficient number of useful social and cultural activities.	26	11	17
26	Municipality organizes activities such as panels, seminars, theatre, concerts for the public.	30	17	29
27	The municipality endeavors to facilitate student life	21	20	19
28	The municipality takes care to meet the vital needs of the elderly and infirm.	24	21	23
29	The municipality contributes to the promotion of the city through its activities.	29	28	28
30	The resources of the municipality are sufficient.	22	18	25
31	Uses municipal resources effectively and efficiently.	7	9	5

When the findings obtained in Table 3 are evaluated, it is seen that the first five prioritized items in the AQS are listed as items 24, 23, 19, 10 and 20, respectively. Based on this ranking, it is seen that

both expectation and perception weights of items 24 and 23 are parallel to the AQS. However, in items numbered 19, 10 and 20, there were noticeable differences between the SQS and the expectation and perception weights in terms of rankings. The main reason for this situation is that arithmetic averages are directly considered in the calculation of the AQS. In contrast, in the entropy method, the related items are subjected to normalization within themselves. Therefore, it is seen that evaluating the entropy weights together with the service quality scores in determining the priority areas is an important and necessary issue for reliable results. In order to have a more detailed and broad perspective, the results obtained are presented graphically in Figure 1.

Figure 1. Graphical Representation of SQS and Entropy Weights Rankings



Paying attention to two points in the interpretation of Figure 1 may enable more accurate identification of priority areas. These points can be explained as the lengths of the columns should be parallel to each other and these columns should be as short as possible since the column lengths show the rankings. As of the results in Table 2, it is seen that items 24 and 23 are both graphically parallel to each other (in terms of AQS, expectation weight and perception weight) and they are quite short. For this reason, it is possible to say that these two items are prioritized areas. However, the items that can be considered more appropriate to follow these two items are items 3, 31 and 4, respectively. Therefore, it is concluded that prioritizing the areas numbered 24, 23, 3, 31 and 4 in Eskişehir can increase the service quality faster.

10. DISCUSSION

Examining the results of the study, it was found that the lowest performance of public services provided by Eskişehir Metropolitan Municipality is in the areas of parking, transport and timely service delivery. In another study conducted with the integrated SERVQUAL-CCDM model developed by

Stević et al. (2021), in parallel with these findings, it was found that the biggest gaps in service quality are in the basic operational dimensions such as 'reliability' and 'timely service'. Therefore, it can be seen that the basic functions of public services have shortcomings in satisfying citizens.

In this study conducted in Eskişehir, the aim is to measure service quality with SERVQUAL scale. SERVQUAL scale, which is used to measure service quality, is one of the traditional quality measurement methods. Although this method is often preferred in studies, it has been criticized with the emphasis that the method needs more objectivity in weighting and prioritization processes and the belief that its use alone is not sufficient in quality measurement. In the study by Ciavolino and Calcagnì (2015), a new integrated model was proposed and applied, taking into account the methodological criticisms made in the literature for SERVQUAL. The entropy method used in our study takes into account the variability of respondents' answers by assigning objective, data-driven weights. This methodological choice is in line with the "Generalized Cross Entropy" approach proposed by Ciavolino and Calcagnì (2015). In the aforementioned study, the SERVQUAL scale was statistically enriched, emphasizing that service quality gaps can be measured more accurately. Similarly, in our study, in addition to the SERVQUAL scale, weights were determined using the entropy method, one of the objective weighting methods. This increased the reliability of the measurement by taking into account the homogeneity/heterogeneity differences in the participants' responses.

Again, the SERVQUAL-FAHP-TOPSIS model developed by Luyen and Thanh (2022) is an important study that demonstrates the multiple benefits of CRM methods in measuring service quality. The study highlights the contribution of fuzzy logic and weighting to the decision making process in determining the relative importance levels of service quality. Our study, which was conducted in Eskişehir, reinforced this approach with the entropy method more simply and directly and presented an accessible and effective solution model in both academic and applied fields. Wang and Dong (2023) combined SERVQUAL with entropy weighting and TOPSIS methods in their study to evaluate the quality of e-commerce logistics services. This enabled them to rank the service providers. In this study, as in our study, service quality scores in dimensions such as 'reliability' and 'empathy' were low and identified as the weakest aspects of quality.

As a result, this study, which aims to measure the quality of public services provided by Eskişehir Metropolitan Municipality, was integrated with the Entropy method, which is one of the CRM models, in order to complete the deficiencies of the SERVQUAL scale mentioned in the literature. In this way, it contributed to a more realistic, objective and decision-maker-oriented evaluation of the public services provided. Compared to similar studies in the literature, the study stands out for its unique data set, its focus on local government and its integrated methodological approach, as well as for its theoretical and practical contributions. It is one of the pioneering studies that puts into practice the aspects suggested by many studies on service quality measurement and presents the results with a sample application in Türkiye. Going beyond traditional SERVQUAL applications, a data-based, objective and

multicriteria analysis perspective has been presented, thus making a significant contribution to quantitative analysis-based service quality assessment in public services.

11. CONCLUSION

SERVQUAL method is the most frequently used method in service quality measurement today as it has been for many years. Although there are criticisms of the SQS part, recent studies have taken these criticisms into consideration and contribute to making the service quality results evaluated with the SERVQUAL scale more reliable. In the literature, the integration of MCDM methods in these evaluations is a very common situation. In the studies, it is generally emphasized that service quality measurements increase reliability with the integration of MCDM methods. However, in most of the related studies, the SQS specific to the SERVQUAL scale is not taken into consideration. The arithmetic mean method used in the calculation of the SDQ is affected by extreme values, which reduces the reliability of the results. Within the scope of the study, it is aimed to contribute to the literature to eliminate this unreliability by integrating entropy with the proposed service quality score. With the approach discussed in the study, the evaluation of the heterogeneity of participant responses as additional information will provide decision makers with the opportunity to make important determinations. The results obtained show that the combined evaluation of the calculated service quality score and the entropy weights of expectations and perceptions helps to focus on more sensitive and accurate areas. In addition, with this integrated approach, it is possible to say that the computational difficulties and complexity that may be encountered in considering different MCDM methods alone can be avoided.

Ethics committee approval for the study was obtained from the Anadolu University Ethics Committee on January 31, 2024, with protocol number 688833.

The authors declare that the study was conducted in accordance with research and publication ethics.

The authors confirm that no part of the study was generated, either wholly or in part, using Artificial Intelligence (AI) tools.

The authors declare that there are no financial conflicts of interest involving any institution, organization, or individual associated with this article. Additionally, there are no conflicts of interest among the authors.

The authors affirm that they contributed equally to all processes of the research.

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