



Research Article

IMPACT SCORE TECHNIQUE AND SERVQUAL COMPARISON FOR  
PUBLIC TRANSPORTATION SERVICE QUALITY

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ABSTRACT

Determination of service quality measures that have the greatest impact on overall satisfaction of a system has many advantages both in favor of passengers and managers. Service quality of a transportation system mostly found by evaluation of passengers attitudes. Especially for managers, it is very important to have knowledge about the expectations and perceptions of passengers that they provide service. In this study, two well-known methods, Servqual and Impact Score Technique (IST) are used to determine the service quality of High Speed Rail System of Turkey operated between Eskişehir and Ankara. Then, the results were compared and an analysis was conducted focusing on the differences that have arisen because of the approaches of the methods. The data collected from 900 passengers of High Speed Rail System (HSRS) were used in the analysis. For Servqual, the expectations and perceptions of passengers were taken into account, while in IST, the ratio of passengers having experienced a problem about the relevant attribute and their perceptions are used. The results show that in IST, the outstanding problematic areas are ranked according to problem experiencing rates; while in Servqual, ranking is mostly shaped by perceptions of passengers. In both methods, the featuring attributes of the system are found to be almost common.

**Keywords:** Service quality, public transportation, impact score technique, servqual.

1. INTRODUCTION

Understanding the qualifications of any service system from consumer's point of view is crucial for a company to remain sustainable. To allocate the resources of a company effectively to improve the problematic areas will make it possible to save money and time and also attract new users. From the 1960s, consumer satisfaction/dissatisfaction studies grew firstly focusing on product and goods industries, then on consumer satisfaction and dissatisfaction in service industries [1]. In modern societies, to attract more people to public transportation systems is an important measure of sustainability which can be achieved by knowing the most important

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variables that the passengers consider when deciding whether or not to use the public transportation systems [2].

When the service quality, satisfaction and loyalty concepts in public transport systems literature are analyzed, it can be seen that by using the results of survey studies, steps to improve the systems have been taken into consideration to help development. In the beginning of 1982 MTA (Metropolitan Transportation Authority) started to study on consumer attitudes towards transportation services. In the following years studies on determining the customer perception of transport services have begun [3].

In this study, it is aimed to analyze the results of two well-known methods in terms of approaches in their measurement structure. These methods are The Impact Score Technique and Servqual. The paper is structured in five sections. Literature related to transportation service quality measurement is discussed in the second section. In methodology section, two methods used in the study are assessed with their advantages and disadvantages. The case study section follows with the data collected for the study and the results of two methods. Finally, the main conclusions are presented in the last section.

## 2. LITERATURE REVIEW

The common method of studies on measuring and evaluating the service quality offered in transportation systems is conducting passenger surveys to determine their perception and expectations about the relevant system. The concept of service quality as a comparison between customers' expectations and actual services performed has obtained wide acceptance following the studies of Parasuraman et al. Most of the studies about service quality of public transport systems are related to either generating a quality index to measure service quality or adapting the existing indexes to public transportation systems [4].

Developing and using new models to measure service quality are the other major issues of the studies conducted ([4] [5], [6], [7], and [8]). Nathaniel (2008) developed a plan to monitor and supervise the service supplied to travelers and used both questionnaires and data obtained from the operator to predict and evaluate 22 indicators defined under 6 measures (punctuality, system safety, cleanliness, comfort of passengers, service presentation and informing of passengers). A neural networks' method is used to appraise passenger satisfaction level by [4]. Eboli and Mazzula (2011-2) proposed a method to measure the public transportation service level based on the use of passenger perception [9].

Garrido et al. (2014) used an Artificial Neural Networks (ANN) model to analyze the service quality perceived by passengers of the public transportation system [10]. Awasthi et al. (2011), have evaluated the service quality of the Montreal subway system by using ServQual in conjunction with fuzzy TOPSIS (Technique for Order Preference by Similarity to Ideal Solution), which is a multi-criteria decision making method ([11], [12]).

The service dimensions that the passengers are asked about their perceptions and expectations used in these questionnaires can be summarized as follows:

- *Informing Passenger* ([1], [5], [8], [9], [13], [14], [15], [16], [17], [18], [19]),
- *The amount and type of cost* ([1], [7], [13], [14], [16], [17], [18], [19]),
- *Accessibility*; ([1], [6], [20]),
- *Delivering Service* ([17]; ([20]; [18]; [14]; [13]; [8]; [21]; [22]; [4]; [1]),
- *Environment of Station* ([18]; [6]; [7]; [14]; [1]; [16]),
- *Safety* ([20]; [18]; [6]; [5]; [9]; [13]; [7]; [8]; [19]; [21]; [22]; [14]; [4]; [1]; [16]; [23]; [24]),
- *Environment of vehicle* ([20]; [21]; [14]; [1]; [16]; [23]; [24]).

Servqual, developed by Parasuraman et al. (1988), is an extensively used measure of service quality ([27]; [28]). In the Servqual method, the dimensions of service quality were formerly

classified under 5 titles: Tangibles, Reliability, Responsible behaviors, Confidence, and Understanding customers (Empathy). Importance and perception ratings of customers, regarding the 22 qualities defined under these titles are made by using a Likert Scale (between “completely agree” and “completely disagree”).

In their study, Cavana et al. (2007) added 3 more dimensions (comfort, connection and convenience) to Servqual for the purpose of determining railway passenger service quality [29]. Jun and He (2007), in their Servqual -based studies, conducted experimental research to adapt Servqual model by utilizing the characteristic qualifications of a railway system [30]. To evaluate the passenger service quality of India Railways, RAILQUAL, which is a new tool, has been developed by Prasad and Shekhar (2010-2). 3 new dimensions (comfort, security and contentment) have been added to the existing five dimensions [22].

The Servqual model for measuring service quality has been subjected to a number of criticisms. Most research studies do not support the five-factor structure of Servqual put forward by Parasuraman et al. (1988), and administering expectation items is also considered unnecessary ([31]; [32]). Barabino (2012) also states that the Servqual framework might be improved with the inclusion of additional attributes.

Cronin and Taylor (1992) have developed their own performance-based measure, the Servperf [27]. In fact, the Servperf. scale is the unweighted perceptions components of Servqual, which consists of 22 perception items thus excluding any consideration of expectations. In their empirical work in four industries, Cronin and Taylor (1992) argue that current performance best reflects a customer’s perception of service quality, and that expectations are not part of this concept.

Another method, The Impact Score Technique (IST) was developed by Morpace International Inc. to measure the transit system users’ satisfaction in 1999 by Cooperative Research Program. The IST approach provides information about the relative impact of the system attributes on overall satisfaction, by measuring the decrease in overall customer satisfaction related to a recent negative experience on a feature of the system. In the studies where IST approach was used [[19], [13], and [20]], the simplicity of the method is stated as a reason to measure the perceived service quality. Easy-convertibility of the obtained results into practical decisions is determined as another advantage of the method [3]. In a previous study, perception of the passengers using High Speed Rail System (HSRS) operating between Ankara and Eskişehir was measured by IST method. The results provided the opportunity to determine the most problematic areas from passenger’s point of view [33]. The main advantage of IST is its easiness to apply and understand for managers. But in this method the expectations of the users are not taken into account which may be considered as a disadvantage. In TCRP Report 47 (1999) it is stated that “*gap scores will not change significantly over time. It is problem occurrence rates that can fluctuate and which can be reduced by transit agency actions. Future increases or decreases in problem occurrence rates can be measured and validated with a t-test or chi-square test. This makes it possible to limit tracking surveys to a re-measure of overall satisfaction and problem occurrence rates for each service attribute*”. [1].

### 3. METHODOLOGY

In this study, the results of two different methods that are being used in measuring service quality will be compared: Servqual and Impact Score Technique. Below, general descriptions of Servqual and IST are given.

**Servqual** In Servqual, the dimensions of service quality are measured by asking passengers about their expectations and perceptions. The dimensions are represented by attributes (items,  $i$ ) and passengers are asked to rate their expectations ( $E_i$ ) and perceptions ( $P_i$ ) in Likert scale (e.g. between 1-5; 1, totally disagree or not important – 5, totally agree or very important) for each attribute. The difference between the expectations and perceptions ( $E_i - P_i$ ) are determined as gap

scores of attributes. The attributes are ranked according to their scores. Greater scores, meaning greater differences between expectations and perceptions, are mostly the attributes that should be enhanced preferentially. An example for Servqual score calculation is given in Table 1.

**Table 1.** An example for Servqual

	A	B	C
	Average perception of passengers (Pi)	Average expectation of passengers (Ei)	(B-A=C) Servqual Gap Score
Attribute 1	3,5	4,5	-1,0
Attribute 2	3,3	4,2	-0,9
Attribute 3	2,3	4,1	-1,8

In this study, the Servqual model was taken as an item-by-item analysis (e.g.  $P_1 - E_1$ ,  $P_2 - E_2, \dots$ ). For each of the questions, average expectation and satisfaction ratings were calculated and the gaps were ranked in increasing order of negative values to find the most problematic areas. To be able to compare the results of the models, factorial analysis was neglected and all 61 questions were taken into account.

**Impact Score Technique (IST)** In IST method, the attributes that have the most impact on customer satisfaction are determined in three steps:

1) For each attribute, besides satisfaction rating ( $P_i$ ), the respondents are asked if they have recently experienced a problem within a 30-day period. The mean overall satisfaction ratings are calculated separately for customers who have had a problem and those who have not (Table 2, columns A and B). The difference of the mean overall satisfaction ratings between these two groups is called the "gap score". The attributes are then ordered according to their gap scores.

2) The percent of customers who stated that they have experienced a problem is calculated (incidence rate-r).

3) The impact score of each attribute is calculated by multiplying the attribute's gap score by the attribute's problem incidence rate. The attributes are then placed in descending order of their impact scores. The attributes which have the bigger impact scores are the drivers of customer satisfaction [1].

**Table 2.** An example for Impact Score Technique (IST)

	A	B	C	D	E
	Average perception of passengers who experienced problem*	Average perception of passengers who have not experienced problem	(B-A=C) Gap score	Incidence rate**	(Cx D=E) Impact Score
Attribute 1	2,5	3,5	1,0	0,55	0,55
Attribute 2	2,3	3,2	0,9	0,44	0,4
Attribute 3	1,3	3,1	1,8	0,17	0,31

\*Within the last 30 days

\*\* Percent of passengers who have experienced a problem within the last 30 days.

The results gained from both models by using the same data has shown that some outstanding features of the models determine the ranking of service quality attributes of the system.

With these determinations, in this study, the results of the previous study found by IST method are compared with the results determined by Servqual using same data. The results gained by Impact Score Technique were presented at the 2016 Annual Meeting of Transportation

Research Board, held in Washington D.C., USA and published in the Transportation Research Record (TRR), Journal of the Transportation Research Board.

### **3.2. Data Collection**

The High Speed Rail System (HSRS) between Ankara and Eskişehir has started to be operated in 2009. It is the first HSRS line and the first part of the HSRS line between Ankara-Istanbul. The length of this railway line is 245 km and the journey takes 1 hour 25 minutes between two cities. For the survey study, 900 passengers using HSRS operating between Ankara and Eskişehir were interviewed on board between the middle of March and the end of April 2015. Half of the interviews took place in the Ankara to Eskişehir direction and the other half in the opposite. 72% of the passengers were interviewed on weekdays; 28% on weekends. Most of the passengers were interviewed in the afternoon hours (42%), 39% in the morning hours and 19% in the evening hours.

For 6.22% of the respondents, the journey that the interview took place was their first experience, while 93.78% stated that they had used the system before. The ages of respondents are between 18 and 69, 53.7% of which are between 25-45. 61.1% of passengers stated their marital status as single. 77.44% of the passengers stated that they have a car (36.44% own car; 41% a family car). 24% of the passengers who were interviewed are unemployed while 62.2% are self-employed and 13% are employees. Most of the passengers have an Associate/Bachelor's Degree (51.2%), while the rest of the respondents are spread across high school graduates. The average of passengers' monthly income was stated as 2625.68 Turkish Liras (TL) which was approximately US\$850 according to the current exchange rate stated by The Central Bank of Turkey.

In this study, to determine the SES (Socio Economic Status) groups, the cross table of the job/education of the individual who generates the income of the house is used. According to SES groups, 64.8% of the passengers are in group AB (high) and the remaining 32.8% is spread among other groups: 16.3% are in group C1 (middle-high), 9% in C2 (middle-low) and 7.4% are in group D (low). It is determined that mostly high SES groups prefer the HSRS.

In the questionnaire (Table 3), passengers were asked to rate their perception and expectation about the service they were given. For all attributes, users also answered the question if they have experienced any problem or not in the last one month. Users rated their perception on a Likert scale, from 1 to 5, ranging from "strongly dissatisfied 1" to "strongly satisfied 5" and their expectations from 1 to 5, ranging from "not important at all 1" to "very important 5". Passengers were asked to rate 61 attributes (Table 3) concerning passenger information, fare level and type, accessibility, station environment, vehicle environment, service delivery and security.

**Table 3.** Attributes asked to passengers to rate in the questionnaire

NO	QUESTION	NO	QUESTION
1	Accessibility to information about HSRS trip	31	Availability of guidance and signs to exits at stations
2	Buying tickets from machines	32	Security to warn disruptive passengers at stations
3	Availability of correct and up-to-date information about HSRS	33	Kindness and care of personnel at stations
4	Ease of using the web site of HSRS	34	Ease of reaching personnel at stations
5	Adequacy of information on the HSRS web site	35	Getting understandable and reliable answers from personnel at stations
6	Using the web site securely	36	X-ray scanners at stations
7	Ease of ticket purchase	37	Ticket checking while getting on board
8	Ease of ticket buying at the station	38	Ease of boarding vehicle with baggage and finding available place for baggage
9	Ticket fare	39	Lighting quality of vehicles
10	Ticket types	40	Availability of information boards and signs in vehicles
11	Availability of wheelchair ramps for disabled passengers	41	Emergency phones/alarms in vehicles
12	Availability of pavements for disabled passengers	42	Air conditioning in vehicles
13	Availability of seats for disabled passengers	43	Number and comfort of seats in vehicles
14	Availability of personnel to help disabled passengers	44	Availability of reversible seats according to movement direction
15	Distance of the station to downtown	45	Cleanliness of vehicles
16	Ease of accessibility to the station with other transportation modes	46	Noise level of vehicles (apart from passengers' noise)
17	Availability/frequency of other transportation modes	47	Speed of vehicles compared to promised speeds
18	Availability of service hours on weekdays	48	Trip times compared to promised times
19	Frequency of service hours on weekdays	49	Completion of trips in promised length of time
20	Availability of service hours on weekends	50	Frequency of vehicle failures
21	Frequency of service hours on weekends	51	Time length of vehicle failures
22	Frequency of service hours generally	52	Availability of announcements in vehicles
23	Reliability of trains (on schedule / punctuality to schedule)	53	General attitude of personnel on vehicles
24	Availability of route maps and schedules at stations and stops	54	Speed of vehicles
25	Availability of announcements at stations	55	Security to warn disruptive passengers on vehicles
26	Lighting quality at stations	56	Kindness and care of personnel on vehicles
27	Cleanliness of stations	57	Ease of contacting personnel on vehicles
28	Air conditioning at stations	58	Getting understandable and reliable answers from personnel on vehicles
29	Security personnel at stations	59	The time of first scheduled trip (06:30)
30	Emergency phones/alarms at stations	60	The time of the last scheduled trip (20:40)
		61	Service period of HSRS (06:30-20:40)

#### 4. RESULTS

In the questionnaire the expectations, perceptions, incidence rates of the passengers are measured. For IST method, the perceptions of passengers are handled separately, according to passengers' experience of any problem. These perception values, and also the problem experiencing rates are used to calculate IST score of each attribute (Table 4). The first 20 questions that featured in the rankings are taken into consideration to simplify the analysis.

**Table 4.** The results of questionnaire related to IST calculations

Q no	Average perception of passengers who experienced problem	Average perception of passengers who have not experienced problem	Incidence rate	IST score
44	1,964	3,519	0,380	0,591
19	2,154	3,677	0,377	0,574
61	1,764	3,390	0,347	0,564
22	2,138	3,657	0,371	0,564
21	2,015	3,550	0,362	0,556
60	1,719	3,310	0,339	0,539
18	2,268	3,772	0,332	0,500
20	2,042	3,612	0,318	0,499
38	2,247	3,713	0,261	0,383
16	2,304	3,834	0,229	0,350
4	2,667	4,103	0,226	0,324
59	2,064	4,058	0,156	0,310
17	2,411	3,743	0,231	0,308
7	2,770	4,235	0,200	0,293
46	2,424	3,972	0,177	0,274
48	2,627	4,183	0,168	0,261
49	2,653	4,183	0,168	0,257
47	2,518	4,143	0,156	0,253
43	2,387	3,949	0,152	0,238
5	2,690	4,004	0,180	0,237
23	2,791	4,322	0,154	0,236

The general perceptions and the expectations of passengers are used to calculate Servqual scores are given in Table 5.

**Table 5.** The results of questionnaire related to Servqual calculations

Question no	Expectations of passengers	Perceptions of passengers	Servqual Score
60	4,538	2,761	-1,776
61	4,532	2,818	-1,714
21	4,437	2,991	-1,446
19	4,509	3,105	-1,404
22	4,493	3,090	-1,403
20	4,451	3,106	-1,345
18	4,513	3,272	-1,241
44	4,075	2,921	-1,154
38	4,444	3,329	-1,115
12	4,595	3,485	-1,110
13	4,547	3,517	-1,031
16	4,483	3,484	-0,999
14	4,553	3,585	-0,968
17	4,393	3,427	-0,967
11	4,587	3,633	-0,953
32	4,417	3,520	-0,897
9	4,432	3,619	-0,813
43	4,490	3,709	-0,781
55	4,441	3,666	-0,775
59	4,519	3,748	-0,771

**Table 6** The first 20 questions ranked according to the results of Impact Score and Servqual

Rank	Question no	IST Scores	Question no	Servqual scores
1	44	0,591	60	-1,776
2	19	0,574	61	-1,714
3	22	0,567	21	-1,446
4	61	0,561	19	-1,404
5	21	0,558	22	-1,403
6	60	0,536	20	-1,345
7	20	0,505	18	-1,241
8	18	0,501	44	-1,154
9	38	0,384	38	-1,115
10	16	0,350	12	-1,110
11	4	0,326	13	-1,031
12	59	0,313	16	-0,999
13	17	0,313	14	-0,968
14	7	0,293	17	-0,967
15	46	0,273	11	-0,953
16	48	0,263	32	-0,897
17	49	0,258	9	-0,813
18	47	0,252	43	-0,781
19	43	0,238	55	-0,775
20	23	0,237	59	-0,771



The results which include the scores and the ranking of the most problematic questions determined by IST and Servqual methods are shown in Table 6. It is seen that 12 questions (Questions 18, 19, 20, 21, 22, 38, 43, 44, 59, 60 and 61) are in common. Ranking the IST scores in descending order shows the ranking of questions according to the passengers experiencing problem mostly. Servqual ranking in ascending order gives the questions with greater gaps between expectations and perceptions of passengers.

When the first 10 questions in ranking of Impact Score and Servqual scores are analyzed, it can be seen that nine of the questions (Question no 18, 19, 20, 21, 22, 38, 44, 60 and 61) are in common. The ranking is shaped according to incidence rate For IST and perceptions in Servqual. For example, in IST, question 16 is in the 10<sup>th</sup> rank, where in Servqual question 12 is ranked in as 10<sup>th</sup> question (Table 6). The average perception score of questions 12 and 16 are equal (Table 5). The incidence rate of 16<sup>th</sup> question (22,19%) carried it to the first ten range in IST method, where expectancy average of question 12 (4,6) which is greater than expectancy of question 16 (4,48) has increased its score of SQ analysis. Even it is not used in the model, the incidence rates of questions featured in Servqual are analyzed as well. The incidence rates, expectancy and perception averages of the questions which are not included in Servqual set (Questions 4, 7, 16, 23, 46, 47, 48, 49) and the questions not included in IST set (Questions 9, 11, 12, 13, 14, 32, 55) can be seen in Table 7.

**Table 7.** The averages of the questions ranked in the first 20 questions by only IST and only ServQual

Only by IST				Only by ServQual			
Q. no	Incidence rate (%)	Average Expectancy	Average Perception	Q. no	Incidence rate (%)	Average Expectancy	Average Perception
4	22,74	4,52	3,78	9	12	4,43	3,62
7	19,98	4,57	3,94	11	11,2	4,59	3,63
16	22,19	4,48	3,48	12	12,7	4,6	3,48
23	15,51	4,55	4,08	13	9,78	4,55	3,52
46	17,69	4,4	3,69	14	10,5	4,55	3,58
47	15,5	4,48	3,89	32	14,92	4,42	3,52
48	16,87	4,52	3,92	55	13,02	4,44	3,67
49	16,87	4,54	3,93				
<b>Average</b>	<b>18,42</b>	<b>4,51</b>	<b>3,84</b>	<b>Average</b>	<b>12,02</b>	<b>4,51</b>	<b>3,57</b>

The average incidence rate of Servqual set questions (12,02%) are smaller than incidence rates (18,42%) of IST set questions. The average expectancies of questions are equal (both 4,51). When perceptions are compared, it is seen that the questions taken into account by Servqual have less average expectancy (average of 3,57) when compared to the expectancies of questions of IST (average perception of 3,84). It was determined in the previous study that the incidence rate order shapes the IST order. It is also clear that the amount of difference between expectancy and perception shapes the ranking of questions according to Servqual. In the previous study of the authors, an interesting point was determined. Most of the passengers (38%) have stated that they have experienced a problem with the reverse seats of the vehicles. So this incidence rate carried the 44<sup>th</sup> question to the top of the most problematic attributes of the system according to IST method. The questions followed this were about the frequency or the scheduling of the trips. The same question is in the 8<sup>th</sup> rank according to the Servqual results. Again, the questions about frequency or scheduling cover the top ranking according to both methods.

## 5. CONCLUSION

Passengers' expectations and perceptions about a system should be understood accurately as much as possible. The results show that The Impact Score model ranks the questions mostly according to the amount of incidence rates. Since the expectancy of the passengers are not taken into consideration, it has no effect on scores. In the Servqual model, the amount of difference between expectancy and perception is used for the ranking of attributes. The amount of gap between expectancy and perception of passengers mostly depends on perception of passengers because expectancy of passengers do not differ from passenger to passenger very much (Table 5). In Servqual the ranking is shaped mostly by perceptions of passengers. The expectations are not used in the analysis of IST, and still the most problematic attributes are almost the same with the results of Servqual where expectations are used. Iacobucci et al. (1994) state that "*The models (both the gap model of service quality and the disconfirmation paradigm of customer satisfaction) predict customers to evaluate a service favorably as long as their expectations are met or exceeded, regardless of whether their prior expectations were high or low, and regardless of whether the absolute goodness of the product performance is high or low.*" [34]. Since they also argue that "absolute" levels (e.g. of the prior standarts) certainly must enter into a customer's evaluation, expectations of passengers must be known in order to provide a good level of service.

In this aspect, a new model that will combine the advantageous features and alleviate the weaknesses of two models are in future plans of authors. The new model, which will add the problem experiencing rate to Servqual evaluation, would give the opportunity of adding customers' pre-evaluation about the system and prior standarts by stating whether they have experienced a problem or not about the relevant question.

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## Conflict of Interest

On behalf of authors, the corresponding author states that there is no conflict of interest.

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