Assessment of sanitation service quality in urban slums of Khulna city based on SERVQUAL and AHP model: A case study of railway slum, Khulna, Bangladesh

Md. Shaharier Alam*, Mili Mondal

Urban and Rural Planning Discipline, Khulna University, Khulna 9208, Bangladesh

A R T I C L E   I N F O

A B S T R A C T

Sanitation facilities are one of the major aspects of an urban area which has paramount importance on the quality of life and environment. The city of Khulna, 3rd largest city of Bangladesh, contains 8.14% slum of total area where poor sanitation facilities exist. Different Government and NGOs provide sanitary latrines in the slums of Khulna city under different sanitation project which hardly meets the demands and expectations of slum people. The present study attempts to assess the urban sanitation service quality of Railway slum of Khulna city based on Customer Satisfaction Index (CSI) where the gap between perception and expectation of the inhabitant of railway slum are evaluated. A combined methodology of SERVQUAL model and Analytical Hierarchy Process is applied in this study for evaluating the gap in term of tangibility, reliability, responsiveness, assurance, and empathy to assess sanitation services in railway slum of Khulna city. The result of CSI indicates that the sanitation service meets moderate satisfaction (58.5%) level of public expectation in railway slum of Khulna city. This combined methodology provides a perspicuous idea of sanitation service quality in a simpler way without any quantitative data requirement which will be helpful in appropriate municipal service planning and management.

1. Introduction

Sanitation, a basic human need, is a significant sector of development which leads to a healthier life and good economic condition (Telmo, 2002). Providing urban sanitation service to each people of the urban area is prioritized as the most important need in the 21st century all over the world. Many government and non-government organizations are working together all over the world for providing sanitation facilities to achieve sustainable urban development, still 2.4 billion people do not have access to improved sanitation in the world (Telmo, 2002). The sanitation status is very worse in developing countries like Bangladesh where only 57.7% of people in the urban area has access to sanitation facilities (World Bank, 2016). The city of Khulna is known as the 3rd largest city of the country which is the house of 1.5 million people now. The city obtained its status as a formal town after the establishment of the municipality in 1884 during the British colonial regime. There are about 1134 slums in Khulna City Corporation (KCC) area that comprise 8.14% of the total area (Bangladesh Bureau of Statistics BBS, 2015) and the sanitation status in these slums is not good at all. Slums are informal settlements in the urban area where people get minimum services as they have an informal identity, informal tenure security, no formal recognition by public sectors etc. (Wankhade, 2015). Khulna City Corporation (KCC) along with various

Non-Government Organization (NGO) are proving sanitation service in many urban slums under different sanitation projects. But the sanitation projects fail in some cases and cannot meet the demand and expectation of slum dwellers. Railway slum is one of the major slums of Khulna city where personal sanitary latrines are hardly found and most of the household use the community sanitary latrines provided by NGOs like WaterAid, Nobolok etc. Due to numerous difficulties such as resource problem, lack of skilled manpower and new technology, corruption, nepotism, lack of coordination etc., these latrines fail to fulfill the demands of slum dwellers and as a result, the sanitation status degrades in the slums which endanger both health and living environment of the urban area. So, it is important to assess the customer satisfaction survey for evaluating customer sanitation demands in the slum area. This study will evaluate the sanitation status of railway slum of Khulna city based on Customer Satisfaction Index (CSI) where the gap between perception and expectation of the inhabitant of railway slum are taken into account.

Many researchers all over the world developed many tools and methods to assess the customer satisfaction of different service facilities at different spatial context. Kansal, Ndimbo, and Chandaniha (2017) used SERVQUAL method for assessing customer satisfaction on urban water service delivery in Tanzanian towns of Songea and Mbeya where a customer satisfaction survey is developed based on SERVQUAL questionnaire. Awasthi, Chauhan, Omrani, and Panahi (2011) proposed a mythology in which SERVQUAL and Technique for Order Preference by Similarity to Ideal Solution method (TOPSIS) are combined to assess urban transportation service delivery in the city of Montreal, Canada. Wisniewski (2001) assess the quality of public service of 32 local authorities of Scotland using SERVQUAL model in which he identifies the gaps which exist between the customer and the service provider. The literature shows that SERVQUAL model is the most used model for assessing service quality such as health care (Curry & Sinclair, 2002; Muhammad Butt & Cyril de Run, 2010; Ramez, 2012), education (Arambewela & Hall, 2006; Tan & Kek, 2004), banking and insurance (Kumar, Tat Kee, & Taap Manshor, 2009; Lam, 1995), hotels (Carrasco, Sánchez-Fernández, Muñoz-Leiva, Blasco, & Herrera-Viedma, 2017; Ukpabi, Olaleye, Mogaji, & Karjaluoto, 2018), transport (Silalahi, Handayani, & Munajat, 2017) and other utility services. This study will use SERVQUAL model for evaluating the sanitation service in railway slum of Khulna city by measuring the gap between expectation and perception of slum dwellers about sanitation service. SERVQUAL model works based on a questionnaire survey on five dimensions of service quality viz. Tangibility, Reliability, Responsiveness, Assurance, and Empathy. The questions of SERVQUAL varies along with the variety of service quality and spatial variation of the socio-economic condition. Sanitation service is very different from other utility service and unavailability of previous work on sanitation using SERVQUAL or similar method are one of the main challenges of this study. In this paper, SERVQUAL model is modified in terms of sanitation service and 22 questions on sanitation service satisfaction of slum dwellers are prepared based on the aforementioned five dimensions of service delivery. In the previous work of literatures, weights of five dimension of SERVQUAL are determined based on the judgment of customers which stimulate biases, partiality and decrease the acceptability of the model. Lack of proper understanding of the five dimensions by the slum dwellers and misinterpretation or biased interpretation by surveyor may mislead the result of the model. In this study, Analytical Hierarchy model is used to develop a pairwise comparison among the five dimensions of service quality based on expert opinion. AHP is a powerful and well-accepted tool of developing comparison among different criteria which prioritize, weights and ranks the criteria based on expert opinion. Boukhari, Djebbar, Amarchi, and Sohani (2017) applied AHP to evaluate the sustainability of water and sanitation service in Algeria where three level of the hierarchy is developed based on 12 expert's opinions. Alam and Haque (2018) used AHP to develop a pairwise comparison among 13 vulnerability criteria and weights them based on the geometric mean of expert opinions. A combined methodology of AHP-SERVQUAL is also used by many researchers (Karpuzcu, 2006; Zhu, Ramanathan, & Ramanathan, 2011) all over the world to measure the gap between perceived and expected service quality. In this paper, we present a hybrid approach integrating SERVQUAL and AHP for evaluation of service quality of urban sanitation in railway slum of Khulna city. In the final stage, a Customer Satisfaction Index (CSI) has been developed based on the gap score from SERVQUAL model and the weight of the dimensions from AHP model to measure the sanitation service status of railway slum of Khulna city. This paper is expected to be helpful in resource targeting for improving sanitation quality of slum area by proving the clear idea of customer's expectation and develop a sustainable, healthy and environment-friendly urban space in Khulna city.

2. Study area

Railway Slum, one of the densely populated slums of Khulna city, located on the bank of Bhairav river under the administrative ward no 21 of Khulna City Corporation in Bangladesh. The slum is surrounded by upper jessore road in the east, Bhairav river from the west, Khalishpur in the north and railway station and BIWTA ghat from the south side (Fig. 1). Railway slum is located in the most vibrant area of Khulna city and has close proximity to CBD area. The slum is living place for 1052 household and 4556 people of Khulna city. But the sanitation quality of the slum is very poor where 7% of the population in this slum has no sanitation facilities and 35% of the population use non-sanitary toilet facilities. To improve the sanitation service, Khulna City Corporation, and different NGOs provides community-based sanitation service in Railway slum of Khulna city. This study will evaluate the gap in perception and expectation of peoples of railway slum about sanitation service quality and their implications in the municipal planning of Khulna city.

3. Research methodology

3.1. Research design

In this section, a discussion about the phase-wise development of a hybrid methodology, which involves identification of the
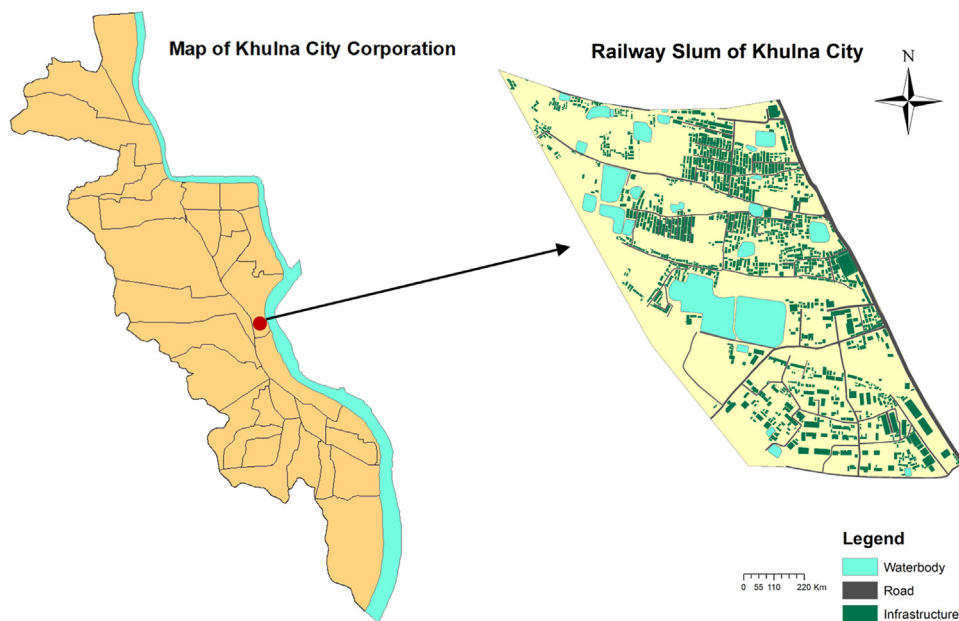
Fig. 1. Map of railway slum of Khulna city.

research focus, a comprehensive search of the literature, selection of variables, sampling, designing and pre-testing of the questionnaire, and scale reliability. This study focused on evaluating sanitation service quality in urban slums of Bangladesh and an extensive literature search is tuned up to determine whether any studies were conducted in Bangladesh. As there exists a little information about sanitation service quality in Bangladesh, a wide-ranging search of literature all over the world is done and opinion of experts are collected to design the research. Based on the extensive literature review and expert opinion, the questionnaire items, methods, validity, and reliability of the questionnaire, the weight of the five dimensions is designed in this research.

3.2. Questionnaire design

This study aims to assess sanitation service quality of urban slums of Bangladesh based on SERVQUAL and AHP integrated methodology. SERVQUAL questionnaire contains 22 questions related to sanitation service quality under five dimensions i.e., Tangibility (5 question), Reliability (5 question), Responsiveness (4 question), Assurance (4 question) and Empathy (4 question). The questions of the abovementioned dimensions are selected based on a comprehensive literature review and expert interview. The questionnaire is developed both in English and Bengali version for the better understanding of experts and slum people. The questionnaire items are rated on five-point Likert scales in a structured format with the verbal statements 'strongly disagree' and 'strongly agree' anchored to the numerals 1 and 5.

3.3. Validity and reliability of the questionnaire

In any primary survey-based research, the measurement of validity and reliability of the questionnaire items is crucial to determine whether items and questions cover the full range of the issues or problem being measured or not. To measure the validity of the 22 questionnaire items, content validity index for individual item (I-CVI) are used in this study. In the development of content validity index (I-CVI), a panel of content experts asked to review the relevance of each question on a 4-point Likert scale where 1 refer to not relevant and 4 indicates very relevant. Using SPSS software platform, the opinion of four experts are analyzed to measure the validity of selected 22 questionnaire items and the result of content validity index (I-CVI) is 0.79 which is considered to be an evidence of good content validity. To measure the reliability of the questionnaire items, Cronbach's alpha method is used based on 15 pilot questionnaire survey and the Cronbach's alpha, covering the overall responses, is found to be 0.72, which is considered a good sign of reliability of the questionnaire.

3.4. Sampling and data collection

The focus of this study is to judge the sanitation service quality of an urban slum based on the opinion of its inhabitants. Because of the preliminary nature of this investigation, dwellers of railway slum are interviewed and not more than one person from each household are interviewed to evaluate the gap between perception and expectation in this study. The total number of household in railway slum of Khulna city is 1052. Due to time and resource constraints, a sample of 70 people has been selected for SERVQUAL

questionnaire survey by simple random sampling procedure keeping the confidence level at 90% with 9.5% margin of error. The data of expectation and perception of respondents are collected during August 2017. The authors interviewed 70 people from 70 different households randomly based on 22 items of the questionnaire and respondents were asked to indicate their expectations and perceptions for each of the 22 items in the questionnaire using a five-point Likert scale, with '1' indicating 'strongly disagree' and '5' indicating 'strongly agree' for each of the 22 statements. When all the data of perception and expectation are collected from the dwellers of railway slum, four expert surveys have been done to determine the weight of five dimensions of SERVQUAL questionnaire.

3.5. Methods

This paper aims to evaluate customer satisfaction on sanitation service of railway slum of Khulna using a hybrid approach combing SERVQUAL and AHP. The proposed hybrid approach follows three major steps. The steps are-

Step-1: Determination of the weight of the five dimensions using Analytical Hierarchy Process (AHP) based on expert opinion.

Step-2: Modification of a SERVQUAL questionnaire in term of sanitation service based on five dimensions of service quality assessment, viz. Tangibility, Reliability, Responsiveness, Assurance, and Empathy and calculate the gap score between expectation and perception.

Step-3: Calculation of Customer Satisfaction Index (CSI) based on multiplication of weight and average perception score.

3.5.1. Analytical Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP), developed by Saaty (1980), has been the most popular tool for the field of decision making because of its simplicity and rationality. AHP follows three major steps of vulnerability assessment. In the first step, a comparison matrix has been developed based on expert opinion on a scale of 1–9 where 1 means two factors are equally important and 9 indicates that one parameter is extremely important than other. The scale of importance developed by Saaty (1980) is shown in Table 1. In the second step, the weight of each factor is calculated from row-multiplied value (RMV), unnormalized and normalized value using Eqs. (1) and (2).

$$\text{Unnormalized value, } mi = \sqrt[n]{RMV} \tag{1}$$

$$\text{Normalized value} = \frac{mi}{\sum_{i=1}^{n} mi} \tag{2}$$

Here mi refers to the unnormalized value of ith parameter and n represents the total influential parameters. In the third step, weight consistencies between judgments are measured using Eqs. (3) and (4). If the consistency ratio > 0.1, the matrix has inconsistency and pairwise comparison must be re-performed between indicators and sub-indicators.

$$\text{Consistency index, } CI = \frac{L - n}{n - 1} \tag{3}$$

$$\text{Consistency ratio, } CR = \frac{CI}{RI} \tag{4}$$

L represents the Eigenvalue of the pairwise comparison matrix and RI is the random inconsistency index which depends on the number of vulnerability assessment parameters (N). The variations of RI value for different number of parameters are shown in Table 2.

In this study, a comparison matrix of five dimensions of sanitation service quality is developed based on judgments of four experts

Table 1
The scale of absolute number for measuring priorities in AHP.

Intensity of Importance	Definitions	Description
1	Equal Importance	Two activities contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one activity over another
5	Strong importance	Experience and judgment strongly favor one activity over another
7	Very strong or demonstrated importance	An activity is favored very strongly over another; its dominance demonstrated in practice
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
Reciprocals of above	If activity 'k' has one of the above non-zero numbers assigned to it when compared with activity 'i', then 'i' has the reciprocal value when compared with 'k'	A reasonable assumption

Intensities of 2, 4, 6 and 8 can be used to express the intermediate values. Intensities of 1.1, 1.2, 1.3 etc. can be used for elements that are very close in importance

Table 2
Random inconsistency indices (RI) for n = 1, 2, …, 10.

N	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

who have knowledge of sanitation and socio-economic condition of urban slums of Khulna city. Then the geometric mean of four expert's opinion is calculated to aggregate the opinions into one matrix (Shown in Table 3). Based on the aforementioned method, the factors are weighted and ranked on the scale 0–1. The value of CR is 0.04, which indicates consistency in pairwise comparison among the dimension of service quality.

3.5.2. SERVQUAL model

SERVQUAL is the combination of two words 'Service' and 'Quality'. It is a prominent tool, developed by Parasuraman, Zeithaml, and Berry (1985), used to evaluate the quality of services offered by the company by checking, functional quality dimensions which identify the gaps which exist between the customer and the service provider. SERVQUAL model deals with the gap between expectation and perception of service provider and customer. The SERVQUAL model has five dimensions for assessing service quality and the dimensions are;

a. Tangibility: Tangibility deals with the appearance of physical facilities, equipment, and personnel of any service. In term of sanitation service, visual appearance latrines, equipment's, water supply facilities represent the tangibility.
b. Reliability: Reliability refers to the ability to perform the promised service dependably and accurately in a specific manner. For sanitation service, this involves the maximum functionality of latrines, water supply system, hand washing equipment's and others.
c. Responsiveness: Responsiveness indicates the willingness of service provider to help customers and provide service within minimum time. For sanitation service, availability, quickness, sincerity, and regularity of sanitation service provider are considered as responsiveness.
d. Assurance: Assurance includes competence, courtesy, credibility, security, knowledge of employees and their ability to inspire trust and confidence in the customer. In term of sanitation service, it involves the security of women and child, the safety of health, courtesy of concern authority etc.
e. Empathy: Empathy refers to access, communication, understanding the customer, caring and individualized attention that the service provider provides its customers. For sanitation service, awareness program for each individual, special facilities for old, women and disabled, community participation etc. indicates the empathy.

In this paper, a hybrid methodology is proposed with the SERVQUAL models and AHP models to assess the sanitation service of railway slum of Khulna city. To evaluate sanitation service in railway slum, 70 respondents had been surveyed based on SERVQUAL model which follows major steps and the steps followed for the assessment are mentioned below,

i. The first step is to determine the questions related to sanitation service quality of slum area in Khulna city. In this step, 22 modified questions related to sanitation service quality are developed based on the five aforementioned dimension i.e., Tangibility (5 question), Reliability (5 question), Responsiveness (4 question), Assurance (4 question) and Empathy (4 question) of sanitation service quality (Table 4).
ii. The second step was for the respondents to provide the linguistic assessment of sanitation facilities and scores on expectation (E) and perception (P) for each attribute from the given statements. The scale used was 1–5: 1—means strongly disagree, 2—disagree, 3—fairly agree, 4—agree, and 5—means strongly agree. The scores depend on perceived impression of existing sanitation service in railway slum and expectation of the service of a respondent in railway slum.
iii. This step includes the assessment of the difference between the perception and expectation (P − E) of respondents about sanitation service in railway slum which gives the SERVQUAL gap score (Table 4).
iv. The average SERVQUAL gap score is assessed for each of the dimension of sanitation service, i.e., reliability, responsiveness, assurance, empathy and tangible.

Table 3
Determination of the weight of the five dimensions based on the geometric mean of expert's opinion.

Dimensions	1	2	3	4	5	RMV	m_i	Weight
1.Tangibility	1	0.59	0.93	0.58	0.42	0.13	0.67	0.12
2.Reliability	2.21	1	1.11	1.68	1.28	5.26	1.39	0.26
3.Responsiveness	1.07	0.90	1	1.19	0.41	0.47	0.86	0.16
4.Assurance	1.73	0.59	0.84	1	0.39	0.33	0.80	0.15
5. Empathy	2.38	0.78	2.45	2.59	1	11.81	1.64	0.31
Total							5.36	1.00

Table 4
Dimension for evaluating the quality of sanitation service and gap score in each criterion.

Dimensions	Questionnaire item	Expectation (E)	Perception (P)	Gap Score (P-E)
Tangibility	Visually appearances of the equipment's in latrines	4.86	3.43	-1.43
	Latrines are well maintained	4.36	3.07	-1.29
	Latrines are hygienic and eco-friendly	3.57	2.57	-1.00
	Visually appearances of water supply facilities or equipment's	4.57	3.00	-1.57
	The sanitary latrines have proper lighting system at night	3.71	2.43	-1.28
Reliability	Functionality of Latrines	4.57	3.36	-1.21
	Latrines are being cleaned regularly	3.64	2.79	-0.85
	The Septic tank is being emptied in a regular basis by concern authority	4.50	2.93	-1.57
	Water supply system is well and fully functional	4.29	3.50	-0.79
	Latrines have good hand washing facilities	4.21	2.64	-1.57
Responsiveness	Service of concern authority is available when it is needed	3.57	2.43	-1.14
	The concern authority shows sincere interest in solving the sanitation related problem	4.00	2.79	-1.21
	The concern authority regular inspects the sanitation conditions	3.71	2.71	-1.00
	Necessary sanitation equipment's are provided as soon as possible if needed	4.00	2.86	-1.14
Assurance	Latrines are secure for women and child at night	4.00	3.29	-0.71
	The latrines follow all standard of safety and hygiene	3.86	3.14	-0.72
	The number of latrines is enough for the household of the slum	4.14	2.57	-1.57
	The staff of concern authorities is polite, confident to the slum people	4.29	2.43	-1.86
Empathy	The sanitation facilities are built and provided with full community participation	3.86	3.29	-0.57
	Regular training and awareness program are arranged to aware each individual	3.43	2.57	-0.86
	Sanitation service also includes proper facilities for old and disabled people	3.71	2.29	-1.42
	Women have different room in the latrines	4.00	3.71	-0.29

v. The weighted SERVQUAL gap score of sanitation service quality is assessed by multiplying the weight of the five dimensions calculated from AHP pairwise comparison to compute average SERVQUAL gap score.

vi. The final weighted SERVQUAL gap score is assessed by summing up all weighted gap scores of each dimension of sanitation service in railway slum of Khulna city.

3.5.3. Customer Satisfaction Index (CSI)

When customers meet their needs from the services, then the customers get satisfied. In case of urban sanitation service quality, functionality and visual appearance of latrines, hand washing facilities and water supply facilities etc. are the measurement criteria of customer satisfaction. The level of satisfaction is the difference between expected and perceived performance of sanitation service on any spatial scale. Customer Satisfaction Index (CSI) represents the satisfaction level of slum dwellers of Khulna city based on the perception of performance sanitation quality, gap score between perception and expectation and the weight of the service dimensions. Customer Satisfaction Index (CSI) can be achieved by following the below-mentioned steps.

i. The Customer Satisfaction Index (CSI) is assessed by multiplying the weight of each attribute by perception (P) of each attribute.

ii. The final Customer Satisfaction Index (%) is assessed by summation of all CSI for each attribute in percentage (Table 5). The CSI is further categorized qualitatively as classified in Table 6.

$$CSI = 100 \times \frac{\{\sum (Importance\,factor) \times (Perception)\}}{Gap\,score} \tag{5}$$

In this paper, CSI is used to assess the level of satisfaction of urban sanitation service quality in Railway slum of Khulna city.

4. Result and discussion

This study endeavors to evaluate the gap in slum dwellers satisfaction based on five dimensions of sanitation service quality using a hybrid approach with the combination of SERVQUAL and AHP model. The result of Customer Satisfaction Index (CSI) signifies that the sanitation service of railway slum of Khulna city meets 58.5% expectations of slum dwellers which is in 'Moderate Satisfied'

Table 5
Summary of weighted SERVQUAL scores for each dimension.

Dimension (1)	Weight (2)	Expectation (3)	Perception (4)	Gap Score (5) = (4) − (3)	Weighted Gap Score (6) = (2)×(5)	CSI
Tangibility	0.11	4.21	2.90	-1.31	-0.14	
Reliability	0.27	4.24	3.04	-1.20	-0.33	
Responsiveness	0.15	3.82	2.70	-1.13	-0.17	
Assurance	0.14	4.07	2.86	-1.21	-0.17	58.48%
Empathy	0.33	3.75	2.96	-0.79	-0.26	
Total	1.00	20.10	14.46	-5.64	-1.07	

Table 6
Performance and level of satisfaction (Ramez, 2012).

Customer Satisfaction Index	Weighted gap score	Level of satisfaction
75–100	≥ 0	Highly Satisfied
65–75	$-1 \leq \text{Gap} < 0$	Satisfied
50–65	$-2 \leq \text{Gap} \leq -1$	Moderate Satisfied
0–50	$\text{Gap} \leq -2$	Unsatisfied

category according to the performance scale shown in Table 6. The aggregated gap score of each dimension of sanitation service is -5.64 and weighted gap score is -1.07 which signifies that there exists a huge gap among the expectation and perception of slum dwellers about sanitation service quality. The negative sign in gap score and weighted gap score proves that the sanitation service quality cannot meet the expectation of slum dwellers of railway slum. The gap is maximum in the case of tangibility which means the slum dwellers is not pleased with the visual appearance of the sanitation service and equipment's. On the contrary, the gap score is minimum for empathy which means the people of the slum area are more or less pleased with the empathy dimension in railway slum. Weighted gap score represents the combination expectation of slum dwellers and experts thinking on the necessity of the dimension on sanitation service quality. The weighted gap score illustrates that concern authority should pay interest in improving the physical condition of the sanitation facilities to increase the reliability of the service and be inclusive to improve empathy status of railway slum of Khulna city. Though the weighted gap score of other dimensions is pretty good, the sanitation quality of railway slum ends up to be in the moderate satisfactory category.

5. City planning implication and future research

Sanitation is one of the major service element that needs to be provided to every household of an urban area in a sustainable manner. Combining the people's opinion of their need and experts thinking is the core idea of participatory city planning. This paper introduced a hybrid methodology in which the perception and expectation of stakeholders are combined with experts thinking on the weight of each criterion to evaluate the quality of a service. After the Quito declaration, the city planning all over the world becomes inclusiveness focused and providing equal service in slum area gets more attention to ensure sustainability and inclusiveness. Sanitation is one of those facilities that need to be provided in the slum area in an equal manner. According to the Khulna City Corporation Ordinance,1984, Khulna City Corporation (KCC) are responsible authority for proving sanitation facility to its citizen. To provide sanitation service to the slum area, a baseline survey of sanitation status, need and demand assessment needs to be done very deeply which requires a huge resource and manpower. This paper proposed a methodology through which the customer satisfaction can easily be done without any quantitative data requirement and by using this method, customer satisfaction on sanitation quality of railway slum are evaluated. The city planning initiatives can easily be decided for railway slum of Khulna city based on the CSI value as this method demonstrates dimension wise gap of sanitation service quality. To improve the sanitation service quality in railway slum of Khulna city, some most important city planning initiative needs to be taken. The city planning initiatives are mentioned below;

a) By combining people's expectation gap from SERVQUAL model and expert's judgment from AHP model, the weighted gap score for each dimension are calculated in this study. The weighted gap score shows that the sanitation service quality is not reliable as the gap score is high for reliability than others. So, concern authority should pay keen interest for improving the physical condition of the sanitation service and equipment in railway slum. Table 4 indicates that hand washing facilities, regular cleaning facilities and proper functionality of the sanitary latrines couldn't meet the expectation of slum dwellers and city authority should prioritize the task by analyzing gap score to maximize the use of resources and time.

b) The weighted gap score prioritizes empathy as the second most important dimension that is in worse condition. Table 4 indicates that the sanitation service in railway slum are less inclusive and there is less or no specialized facilities for old and disabled people. The city authority and related NGOs should provide specialized sanitation facilities for old and disable in the slum area.

c) The weighted gap score for responsiveness, reliability, and tangibility are quite similar and concern authority should prioritize their initiatives based on the average gap score provided in Table 4.

d) This study is done in only one slum of Khulna city which is not quite representative of the overall sanitation status of slum areas. This hybrid method can be applied in the other slum of Khulna city for the better understanding of sanitation needs and city planning initiative.

6. Conclusion

Providing safe, sustainable, hygienic and environment-friendly sanitation service to the inhabitants of an urban area has been an element of significant importance to the city authority. This study introduced a combined methodology of SERVQUAL and AHP to measure customer satisfaction of railway slum about the quality of sanitation service which can be used as a powerful tool of stakeholder analysis in the urban area. A modification of the questionnaire has been done in term of sanitation service, and the perception and expectation of the slum dwellers were collected and analyzed to evaluate the customer satisfaction railway slum of

Khulna city. The result shows that the customer satisfaction is moderate satisfactory (58.5%) which can be enhanced by implementing several initiatives such as improvement of hand washing, cleaning, and water facilities, providing specialized sanitary service to old, disable and women, an awareness campaign for slum dwellers etc. The city planning initiatives can be prioritized using this method based on gap score to maximize the use of resources for improving sanitation service of Khulna city. This methodology can be applied to any type of service at any spatial scale to measure the quality of the provided service.

References

Alam, M., & Haque, S. (2018). Assessment of urban physical seismic vulnerability using the combination of AHP and TOPSIS models: A case study of residential neighborhoods of Mymensingh city, Bangladesh. *Journal of Geoscience and Environment Protection, 6*, 165–183. https://doi.org/10.4236/gep.2018.62011.

Arambewela, R., & Hall, J. (2006). A comparative analysis of international education satisfaction using SERVQUAL. *Journal of Services Research, 6*, 141.

Awasthi, A., Chauhan, S. S., Omrani, H., & Panahi, A. (2011). A hybrid approach based on SERVQUAL and fuzzy TOPSIS for evaluating transportation service quality. *Computers Industrial Engineering, 61*(3), 637–646.

Bangladesh Bureau of Statistics (BBS) (2015). *Census of slum areas and floating population 2014. Preliminary survey report.* Statistics and Information Division, Ministry of Planning, Government Peoples' Republic of Bangladesh (Retrieved from ⟨http://www.bbs.gov.bd/WebTestApplication/userfiles/Image/Slum/Preli_Slum_Census.pdf⟩).

Boukhari, S., Djebbar, Y., Amarchi, H., & Sohani, A. (2017). Application of the analytic hierarchy process to sustainability of water supply and sanitation services: The case of Algeria. *Water Science and Technology: Water Supply,* ws2017194.

Carrasco, R. A., Sánchez-Fernández, J., Muñoz-Leiva, F., Blasco, M. F., & Herrera-Viedma, E. (2017). Evaluation of the hotels e-services quality under the user's experience. *Soft Computing, 21*(4), 995–1011.

Curry, A., & Sinclair, E. (2002). Assessing the quality of physiotherapy services using SERVQUAL. *International Journal of Health Care Quality Assurance, 15*(5), 197–205.

Kansal, M. L., Ndimbo, I. J., & Chandaniha, S. K. (2017). Urban water service quality assessment in Tanzanian towns of Songea and Mbeya. *Sustainable Water Resources Management, 3*(4), 491–501.

Karpuzcu, H. (2006). Measuring service quality in distribution logistics using SERVQUAL and AHP: A case study in a pharmaceutical wholesaler in Turkey.

Kumar, M., Tat Kee, F., & Taap Manshor, A. (2009). Determining the relative importance of critical factors in delivering service quality of banks: An application of dominance analysis in SERVQUAL model. *Managing Service Quality: An International Journal, 19*(2), 211–228.

Lam, S. S. (1995). Measuring service quality: An empirical analysis in Hong Kong. *International Journal of Management*.

Muhammad Butt, M., & Cyril de Run, E. (2010). Private healthcare quality: Applying a SERVQUAL model. *International Journal of Health Care Quality Assurance, 23*(7), 658–673.

Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1985). A conceptual model of service quality and its implications for future research. *the Journal of Marketing,* 41–50.

Ramez, W. S. (2012). Patients' perception of health care quality, satisfaction and behavioral intention: An empirical study in Bahrain. *International Journal of Business and Social Science, 3*(18).

Saaty, T. L. (1980). *The analytic hierarchy process.* New York: McGraw-Hill.

Silalahi, S. L. B., Handayani, P. W., & Munajat, Q. (2017). Service quality analysis for online transportation services: Case study of GO-JEK. *Procedia Computer Science, 124*, 487–495.

Tan, K. C., & Kek, S. W. (2004). Service quality in higher education using an enhanced SERVQUAL approach. *Quality in Higher Education, 10*(1), 17–24.

Telmo, A. C. (2002). *A water supply and sanitation study of the village of Gouansolo in Mali (Doctoral dissertation).* West Africa: Michigan Technological University.

Ukpabi, D., Olaleye, S., Mogaji, E., & Karjaluoto, H. (2018). Insights into online reviews of hotel service attributes: A cross-national study of selected countries in Africa. *Information and communication technologies in tourism 2018* (pp. 243–256). Cham: Springer.

Wankhade, K. (2015). Urban sanitation in India: Key shifts in the national policy frame. *Environment and Urbanization, 27*, 555–569. https://doi.org/10.1177/0956247814567058.

Wisniewski, M. (2001). Using SERVQUAL to assess customer satisfaction with public sector services. *Managing Service Quality: An International Journal, 11*(6), 380–388.

World Bank (2016). World development indicators: Featuring the sustainable development goals. Washington, D.C. Retrieved from ⟨http://databank.worldbank.org/data/download/site-content/wdi-2016-highlights-featuring-sdgs-booklet.pdf⟩.

Zhu, J. C., Ramanathan, R., & Ramanathan, U. (2011). Measuring service quality using SERVQUAL and AHP: An application to a Chinese IT company and comparison. *International Journal of Services and Operations Management, 8*(4), 418–432.