EVALUATION OF SANITATION SERVICE QUALITY IN RAILWAY STATIONS USING SERVQUAL MODEL ALONG THE RAIL ROUTE FROM KHULNA STATION TO ISHWARDI STATION: A CASE STUDY

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ABSTRACT

Access to safe drinking water and sanitation is a fundamental human right, vital for sustaining healthy livelihoods and essential for maintaining the dignity of every individual. Railways play a vital role in inland transportation, connecting various regions of a country. Railway stations typically operate continuously and experience high occupancy rates, as thousands of passengers travel each day. Sanitation facilities at railway stations are a key aspect of public health, helping to prevent disease transmission, providing access to essential hygiene services, enhancing passenger comfort and satisfaction, and maintaining the overall cleanliness and reputation of the transportation system. Railway authorities are obligated to progressively achieve universal access to sanitation services, considering their available resources. They are also responsible for developing regulatory frameworks, policies, and budget allocations to ensure the provision of these services. The railway stations along the route from Khulna Station to Ishwardi Junction Station have been selected as study areas within the West Zone of Bangladesh Railway due to their significant regional influence. This study aims to assess the sanitation facilities at different stations and examine the factors affecting accessibility to these facilities. To assess the gap between stakeholders' expectations and perceptions, the SERVQUAL research instrument was used, which is a well-known multi-dimensional tool. Data were gathered through a questionnaire survey, where stakeholders answered a series of questions based on five key dimensions: Tangibility, Reliability, Responsiveness, Assurance, and Empathy. The average negative gap of -1.26 between stakeholder perceptions and expectations, highlights a significant shortfall in meeting the expected standards of sanitation services.

Keywords: *SERVQUAL, sanitation, service quality, stakeholders' satisfaction.*

1. INTRODUCTION

Providing sanitation services at railway stations is crucial for safeguarding public health, enhancing the passenger experience and satisfaction, and maintaining professionalism and operational efficiency. In Bangladesh, rail transport is one of the two main land-based transportation modes, alongside road transport, and is considered the most popular and user-friendly option. Railways are cost-effective, environmentally friendly, comfortable, and safe, playing a crucial role in transporting both passengers and goods (BR, 2019). Compared to road transport, railways have a lower environmental impact, producing fewer greenhouse gases, requiring less fuel and land per unit of operation, and operating with greater efficiency (Laskar, 2017). Bangladesh Railway (BR) is becoming increasingly instrumental in the country's development, providing essential social services as the nation evolves (BR, 2019).

Railway stations, essential components of rail transport, can range from simple to complex and are pivotal in serving passenger needs (Sideris et al., 2015). Discrepancies between the facilities provided by railway stations and the needs of the population can significantly affect customer satisfaction with railway services (Brons et al., 2009). Assessing customer satisfaction is essential for the railway system, as it guides decisions to enhance facilities, adjust train schedules, establish new stations, and modify passenger capacity (Chandrasena & Silva, 2019). Railway stations provide essential passenger services around the clock, addressing needs related to sanitation, energy, and other requirements. Efforts are being made globally to develop green, sustainable, and passenger-friendly railway stations that minimize emissions, generate energy, enhance operational performance, and ensure customer satisfaction (Hamed, 2023).

Every individual has the right to access safe drinking water in sufficient quality and quantity to meet their basic needs (Ahmed & Rahman, 2000). Effective and efficient utilization of water and sanitation facilities is key to sustainability (Ahmed & Rahman, 2000). A sustainable water supply or sanitation system efficiently provides reliable services of a desired level at railway stations. As key public transport hubs experiencing high passenger volumes, effective sanitation directly impacts the overall quality, reputation, and sustainability of the rail network. Clean and well-maintained facilities, especially restrooms, significantly enhance the overall passenger experience and comfort, making public transport a more inviting option. Providing adequate and inclusive sanitation facilities, including specialized options for the old and disabled, demonstrates social responsibility and contributes to more sustainable and equitable development. So, it is essential to evaluate customer satisfaction surveys regarding the demand for sanitation facilities in the station premises. Sanitation services are being provided at various railway stations by the railway authorities themselves, as well as by selected non-governmental organizations (NGOs) under various sanitation projects. However, these projects often face challenges that prevent them from fully meeting the needs and expectations of commuters. Issues such as resource shortages and a lack of coordination contribute to these difficulties.

The SERVQUAL method has been extensively used in research and case studies to evaluate service quality in public utility contexts. It helps to improve service quality by measuring the gap between users' expectations and their perceptions of the actual services delivered. It assists service providers in identifying specific areas of weakness and prioritizing improvements based on user feedback. Sanitation services differ significantly from other utility services, and due to the lack of previous studies on railway sanitation, the SERVQUAL model was employed to evaluate sanitation services at the station. This model takes into account the gap between users' perceptions and their expectations of the sanitation services provided. SERVQUAL model works based on a questionnaire survey on five dimensions of service quality, viz. Tangibility, Reliability, Responsiveness, Assurance, and Empathy, and the questions of the method were modified in terms of the sanitation services provided. This paper is expected to be helpful in resource targeting for improving sanitation quality by providing a clear idea of commuters' expectations and developing sustainable, healthy, and environmentally friendly rail stations in the Bangladesh railway.

2. METHODOLOGY

2. 2.1 General

The methodology of a research study is determined by its nature and objectives. Every research study has a specific method tailored to its goals. A well-functioning transport system is crucial for the success of the economy and for improving people's quality of life. The transport plan for sustainable development should incorporate fundamental policies aimed at conserving resources and protecting the environment. In a land-scarce nation like Bangladesh, railways could play a critical role as a viable and sustainable mode of transport, considering the country's socio-demographic, geopolitical, and economic contexts. A high-capacity, efficient, and environmentally sound transport system is essential; this is where rail can make a significant impact. The full potential of the railway can only be realized through planned investments in stations, tracks, signaling, rolling stock, and maintenance and also improvements in service quality and operational efficiency. Based on these arguments, this study aims to evaluate the quality, availability, and adequacy of water and sanitation facilities at stations, while also identifying the factors that affect accessibility to these facilities in the study area.

3. 1.2 Selection of the Study Area

This study presents a cross-sectional analysis conducted at various railway stations along the route from Khulna Station to Ishwardi Junction Station in the West Zone of Bangladesh Railway. The water and sanitation facilities at the railway stations on this route, including Daulatpur, Noapara Bazar, Jashore, Mobarakganj, Kotchandpur, Darshona Halt, Chuadanga, Alamdanga, Poradah Junction, Mirpur, Bheramara, and Pakshi were documented and their existing conditions assessed. These stations are crucial for the West Zone and were selected for their significant regional influence within the railway network. This route connects the south-western part of the country with other regions, handling substantial freight and passenger traffic and facilitating regional trade.

4.

Figure 1: Study Area Route (Stations along the route: BR, 2019)

5. 1.3 Scope of the Study

Bangladesh Railway is one of the largest public enterprises in the country and is often referred to as the lifeline of the nation. It plays a vital role in the transport communication sector and contributes significantly to the socio-economic development and industrialization of Bangladesh. BR operates both as a public utility service and a commercial enterprise. As a public utility, it has a responsibility to provide essential station facilities to accommodate the needs of its large number of passengers. As a commercial entity, it must generate sufficient revenue by reducing operational and maintenance costs while adopting sustainable practices in water and energy consumption. To attract local and international commuters, it is essential for railway stations to provide well-decorated waiting rooms, properly equipped washrooms with adequate sanitation services, and modern ticket counters that adapt to new technological advancements and changing passenger needs. However, analyzing the quality of water and sanitation facilities for commuters and other stakeholders as well as the factors affecting accessibility to these facilities at railway stations and within the railway system has not yet been widely done which could lead to enhanced passenger services. In essence, the SERVQUAL method allows public health officials and urban planners to move beyond just providing infrastructure (technical quality) to ensuring that the services are delivered effectively and meet the human and social needs of the population (functional quality).

1.4 Assessment of Water and Sanitation Service Quality Using SERVQUAL Model

The SERVQUAL method, which stands for SERVice QUALity, is a well-known tool developed by Parasuraman et al. in 1985. It is used to evaluate the quality of services offered by service providers. The method assesses various dimensions of functional quality and identifies gaps that may exist between customers and service providers. Customers judge service quality as high or low based on whether service performance aligns with their expectations. If the perceived quality exceeds expectations, customers regard it as high quality; conversely, if it falls below expectations, they see it as low quality. The quality of service is frequently regarded as equivalent to customer satisfaction. The SERVQUAL model assesses service quality through five key dimensions, which are tailored for the sanitation services context:

- **Tangibility:** The physical components and material conditions of the provided sanitation services include sanitation facilities, equipment, and fittings such as bib/pillar cocks, flush valves, and showers. The reliability and quality of the water supply systems; functional and adequate lighting ensures safety at night. Hygiene and visual appearance factors include the presence of soap, handwashing facilities, and menstrual hygiene products, as well as the availability of necessary maintenance tools and the professional appearance of staff or sanitation workers. The visible absence of waste, odors, or pests and the overall condition of the sanitation infrastructure, including the structural integrity and cleanliness of the toilets and wash areas.
- **Reliability:** The ability to deliver the promised service consistently and accurately. For sanitation, this means ensuring the consistent functionality of latrines, regular cleaning and maintenance schedules, reliable water supply within the facilities, and the timely emptying of septic tanks by concerned authorities.
- **Responsiveness:** The willingness of the service provider to assist users and deliver prompt service. This involves the availability and sincerity of the authorities in solving sanitation-related problems, regularity of inspections, and quick provision of necessary equipment if needed.
- **Assurance:** The expertise, courtesy, and credibility of service providers help to build user trust. In the context of sanitation, this involves ensuring the safety of facilities for vulnerable groups such as women and children, complying with safety and hygiene standards, providing an adequate number of toilets on station premises, and demonstrating professional behavior by staff.
- **Empathy:** The service provider offers personalized and compassionate care to its users. This dimension includes community participation in the planning of facilities, special provisions for the old and disabled, arranging awareness programs, and a general understanding of users' specific needs and challenges.

Service quality is a crucial attribute for service providers. Insights into service quality help organizations develop programs to address gaps and plan for the future. It plays an essential role in ensuring customer satisfaction, cost reduction, fostering customer loyalty and relationships, retaining clients, and ultimately enhancing profitability (Islam, 2012). A company should always pay close attention to customer perceptions and expectations. When there is a difference between what customers expect and what they perceive, a gap is created. This gap can stem from either factual information or emotional responses. However, what truly matters is how customers perceive the service they receive (Friday and Cotts, 1995). When this perceived performance fails to meet the expectation, then a gap is created between them. The service quality model of Parasuraman et al. (1985) deals with the 05 five key gaps between expectation and perception of the service provider, and these gaps are: Research gap, Planning and design gap, Implementation gap, Communication gap, and Reality gap.

1.5 Functioning of the SERVQUAL

The SERVQUAL model is a widely recognized method for measuring the gap between customer expectations and their perceptions of service quality. It defines service quality as the difference between what customers anticipate from a service and how they perceive the actual service they receive. The model asks respondents to answer questions about both their expectations and their perceptions (Parasuraman et. al., 1985). The gap between expectations and perceptions determines customers' service quality perception as shown on figure 3.12 below:

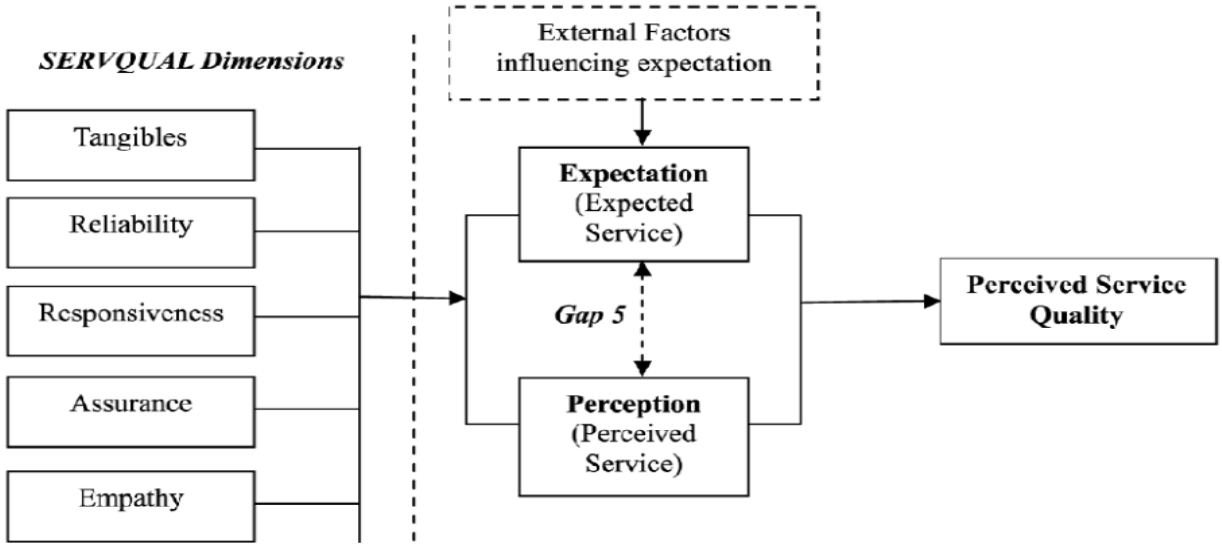

Figure 2: Measuring of service quality using SERVQUAL model (Kumar et al., 2009)

The core formula for the service quality gap is:

$$SERVQUAL\ (Q) = Perceptions\ (P) - Expectations\ (E) \quad (1)$$

A negative gap score indicates that the quality of service is below customers' expectations, highlighting areas that require improvement. Customers' expectations are influenced by external factors that service providers can control, as shown in the accompanying diagram. Gap 5 in the diagram represents the difference between customers' expectations and their perceptions, which is known as perceived service quality (Kumar et al., 2009). This study specifically focuses on this gap, examining the discrepancy between expectations and perceptions of sanitation services at railway stations.

2.2 Formulation of Questionnaire

To evaluate the quality of sanitation services at railway stations, a SERVQUAL questionnaire was developed that includes 22 questions pertaining to sanitation service quality. These questions are categorized into five dimensions: Tangibility (5 questions), Reliability (5 questions), Responsiveness (4 questions), Assurance (4 questions), and Empathy (4 questions). The questions for these dimensions were selected based on a thorough literature review and consultations with experts. The dimensions are further divided into two segments: expectations and perceptions. The questionnaire has been created in both English and Bengali to ensure better understanding for both experts and the general public. The questionnaire items are rated on a five-point Likert scale in a structured format, with verbal statements anchored to the numerals 1 and 5, corresponding to the responses 'strongly disagree' and 'strongly agree'.

There is also a demographic part that provides general information about respondents. This includes railway station users of different ages, genders, professions, and frequencies of train journeys. These data help us better understand the respondents' profiles and relate them to how they perceive sanitation services at railway stations. We randomly selected 300 people from various professions and from selected stations. Service quality was measured using the SERVQUAL model (Kumar et al., 2009). The questionnaire was pre-tested to ensure proper wording, appropriate length, and logical sequencing of questions. For the qualitative aspect, we conducted 20 key informant interviews (KII) with high-level personnel from Bangladesh Railway. We also interviewed experts in alternative water sources and renewable energy options. These interviews were done using purposive sampling. In purposive sampling, the sample size is small, and unit selection is based on the researcher's judgment (Bryman, 2008).

Figure 3: Existing 2nd class toilet an Wash area at Khulna railway station

Figure 4: Inclusive modern public toilet at Panchagarh railway station constructed and operated by WaterAid.

6.

7. RESULTS AND DISCUSSION

3.1 General

This chapter discusses the results derived from the data collected and analyzed using the study's objectives. Stakeholder satisfaction with water use and sanitation services at railway stations was evaluated through the SERVQUAL method. Statistical techniques such as percentage corresponding, Mean Deviation, and standard deviation were applied via Microsoft Excel. The results are displayed using tables, figures, graphs, and charts, as well as described in writing. As a result, major issues and possible solutions have been identified.

3.2 Gap Score Calculation of Sanitation Services Quality Using SERVQUAL Model

This study evaluates satisfaction gaps among railway station stakeholders regarding five sanitation service quality dimensions, as assessed using the SERVQUAL model. Mean values for perceptions, expectations, and gap scores are calculated for each dimension and its respective items. A negative gap score indicates that the services provided did not meet passengers' expectations. Thus, the gap between expectations and perceptions highlights areas requiring improvement.

Table 1: Means of quality expectation (E), perception (P) and gap (G) score

Dimension	S.L. no.	Items	Mean Score of Items			Mean Score of Dimension		
			E	P	G	E	P	G
Tangibility	1	Visually appearances of the equipment's in toilets like pan, basin, flash, cock, shower etc. (sanitary ware)	4.81	4.09	-0.72	4.56	3.67	-0.89
	2	Toilets are well maintained	4.43	3.48	-0.95			
	3	Toilets provide both hygiene and comfort	4.57	3.6	-0.97			
	4	Visual aspects of water supply facilities	4.4	3.64	-0.76			
	5	The sanitary toilets are equipped with a proper lighting system for nighttime use	4.6	3.52	-1.08			
Reliability	1	Functionality of Toilets	4.35	3.39	-0.96	4.38	3.25	-1.13
	2	Toilets are being cleaned on a regular basis	4.46	3.16	-1.3			
	3	The septic tank is being emptied regularly	4.43	3.21	-1.22			
	4	The water supply system is fully functional and operating well	4.37	3.29	-1.08			
	5	The toilets are equipped with adequate handwashing facilities	4.28	3.21	-1.07			
Responsiveness	1	The service from the relevant authority is available whenever it is needed	4.17	2.79	-1.38	4.29	2.88	-1.41
	2	The concerned authority demonstrates a genuine interest in addressing the sanitation-related problems	4.33	2.9	-1.43			
	3	The relevant authorities regularly inspect sanitation conditions	4.18	2.66	-1.52			
	4	If necessary, sanitation equipments provide as soon as possible.	4.48	3.16	-1.32			
Assurance	1	Toilets and wash areas are safe for women and children at night	4.37	3.3	-1.07	4.38	3.03	-1.35
	2	The toilets maintain all safety and hygiene standards	4.39	3.12	-1.27			
	3	The number of toilets is enough for all at the station	4.47	2.89	-1.58			
	4	The staff of the relevant authorities is polite and confident when interacting with toilet users.	4.29	2.79	-1.5			
Empathy	1	Full community participation to keep functional of the toilets	4.23	2.49	-1.74	4.35	2.83	-1.52
	2	Regular training and awareness programs are organized to inform and educate every individual	4.24	2.47	-1.77			
	3	Sanitation services also include proper facilities for elderly and disabled	4.23	2.69	-1.54			

	individuals			
4	Separate toilets for women at wash area	4.68	3.68	-1

Based on the analysis of the mean values of the dimensions, all the values perceived as negative as compared to stakeholders' expectations. The highest gap is for Empathy of sanitation facilities, with the gap score of **-1.52**, and the lowest gap is for tangibility of sanitation facilities, with the gap score of **-0.89**. When the mean values of the items are analyzed, results indicated that the item "Visually appearances of the equipment's in toilets like pan, basin, flash, cock, shower etc. (sanitary ware)", has lowest value with the gap score of -0.72 which means most of the sanitation facilities user at railway station found physical existences of toilet's sanitary ware like pan, commode, basin, shower etc. whether is works or not. The highest gap is for the item "Regular training and awareness program are arranged to aware each individual", with the gap score of -1.77 which means lacking of community participation and awareness building campaign among stakeholders of sanitation facilities at railway stations. There is no item which gap value is positive between stakeholders' expectations and perceptions. Data analysis shown in Table 4.9 also point at the rank of the dimensions according to gap score (from lowest to highest): Tangibility (-0.89) <Reliability (-1.13) < Assurance (-1.35) <Responsiveness (-1.41) < Empathy(-1.52). The gap between perception and expectation represents the quality of SERVQUAL model. The table below represents the gap between the average expectations and perceptions of each dimension.

Table 2: Quality variations across the five dimensions of SERVQUAL model

Dimension	E	P	Q
1. Tangibility	4.56	3.67	-0.89
2. Reliability	4.38	3.25	-1.13
3. Responsiveness	4.29	2.88	-1.41
4. Assurance	4.38	3.03	-1.35
5. Empathy	4.35	2.83	-1.52
Average	4.39	3.13	-1.26

The figures from Table 2 are illustrated in the graphs in Figure 5 and Figure 6 below:

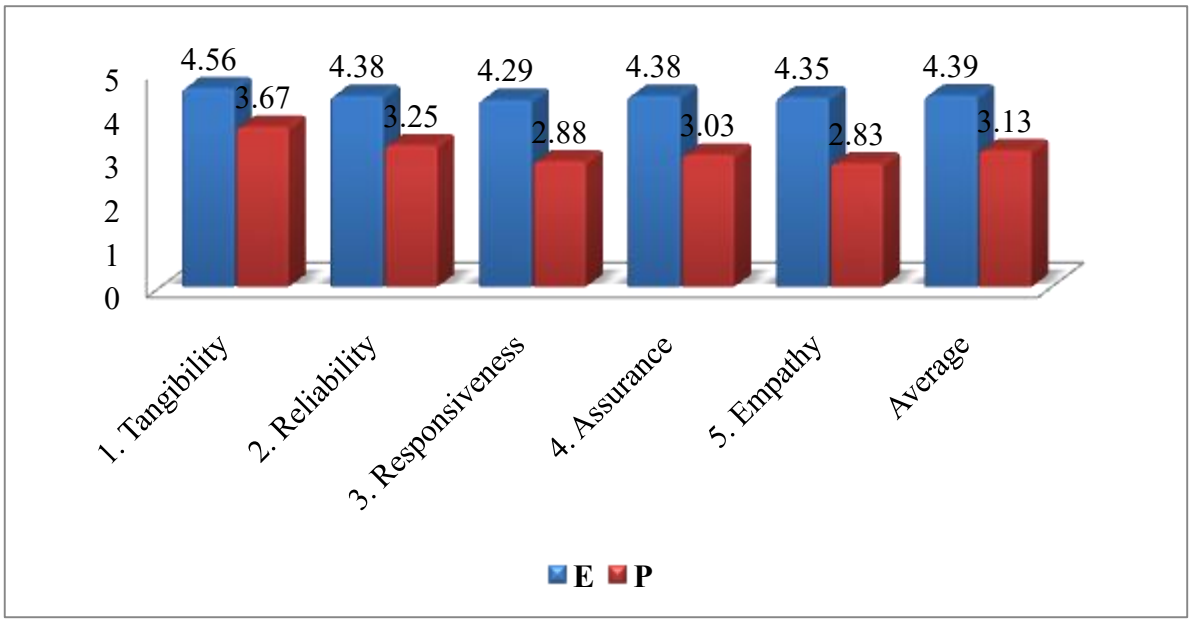

Figure 5: Gaps between perception and expectations

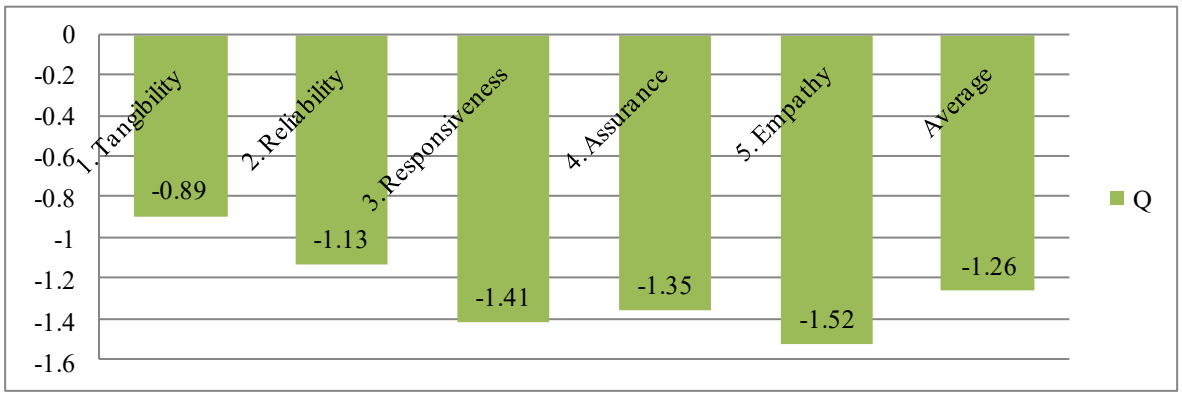

Figure 6: Identifying quality gaps across multiple dimensions is essential for improvement

According to figures 4.3 and 4.4, a comparison of stakeholder expectations for railway station services with their perceptions shows that the average scores for the five expectation dimensions are higher than those for the five perception dimensions. This indicates that stakeholders are not receiving the services they expect. Therefore, it can be concluded that there is a significant shortfall in meeting stakeholder expectations across all service dimensions.

CONCLUSIONS

It is crucial for the competent authority to provide safe, sustainable, hygienic, and environmentally friendly sanitation services for railway stakeholders. A commuter satisfaction survey, based on the SERVQUAL model, was developed after analyzing the characteristics of sanitation services and the factors influencing their quality. The questionnaire was tailored to focus specifically on sanitation services, collecting and analyzing the perceptions and expectations of station users to assess customer satisfaction within the railway system. According to the Bangladesh Railway Citizen Charter, it is the responsibility of Bangladesh Railway to offer various supporting services to customers (passengers) on platforms. These services include security, information, lighting, seating, sanitation, access to clean drinking water, courteous service, and the availability of affordable refreshment options. However, findings from the SERVQUAL model reveal a negative gap between service users' expectations and their actual experiences. Therefore, the results of this study can help authorities and policymakers within Bangladesh Railway in planning effective interventions to improve service delivery and reduce the discrepancies in service quality.

Improving sanitation services at railway stations requires a comprehensive approach that includes the following key strategies: Establish rigorous cleaning schedule to ensure consistent cleanliness; Upgrade restroom facilities including fixtures and fittings to guarantee adequate availability and comfort; Adopt advanced disinfection methods to enhance hygiene standards; Implement smart systems that enable real-time monitoring and prompt intervention when necessary; Utilize modern cleaning technology such as robotic cleaners and bio-toilets to improve efficiency; Conduct regular monitoring and surprise checks to maintain high standards of cleanliness; Manage contracts effectively with cleaning and catering agencies to ensure accountability; Provide staff training and resources to ensure that personnel are equipped to perform their duties effectively; Intoduce Public Private Partnership (PPP) in construciton and operation phase to ensure hyegine and cleanliness, and paid services; Launch awareness campaigns aimed at passengers and other stakeholders to promote the importance of sanitation; Offer accessible feedback mechanisms such as digital platforms, mobile apps, or QR codes, for complaints and suggestions; Accommodate special needs for women, the elderly, and individuals with disabilities; Mandate waste segregation at stations to promote sustainability and Coordinate with local authorities and encourage community involvement in sanitation efforts. By adopting these measures, sanitation services at railway stations could be greatly improved.

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DECLARATION

I have not used any AI tools or technologies to prepare this paper.

REFERENCES

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

Friday, S., and Cotts, D. G. (1995). "The Facility Management: A Marketing and Customer Service Approach," *New York, USA, Wiley & Sons, 1st edition, 1995*.

Ahmed, M. F. and Rahman, M. M., (2000). "Water Supply and Sanitation: Rural and Low Income Urban Communities," *International Training Network*, Dhaka.

Bryman, (2008). "Social Research Methods," 3rd edition, Oxford University Press, New York.

Brons, M., Givoni, M., and Rietveld, P. (2009). "Access to railway stations and their potential in increasing rail use," *Transportation Research Part A*, pp.136-149.

Kumar, M., Kee, F. T., and Manshor, A. T. (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*, Vol. 19, Number 2, p. 211-228.

Islam, M. R. (2012). "Application of SERVQUAL Model in Customer Service of Mobile Operators: A Study from the Context of Bangladesh," *European Journal of Business and Management*, ISSN 2222-1905 (Paper), 2222-2839 (Online), Vol 4, No.1, 2012.

Sideris, L., Taylor, B. D., and Voulgaris, C. T. (2015). "Passenger flows in underground railway stations and platforms," *Mineta Transportation Institute Report*.12-43.

Laskar, M. A. R. (2017). "Piezoelectricity: An Energy Source for Future Railway Stations," *SEU Journal of Science and Engineering*, Vol. 11, No. 2, December 2017.

BR, (2019). "Railway Master plan, (July 2016 to June 2045)." Ministry of Railways, Government of the People's Republic of Bangladesh. (Accessed on 06/011 /25).

Alam, M.S. and Mondal, M. (2019). "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," *Journal of Urban Management*, 8 (2019) 20–27.

Chandrasena, P.D.S.B. and De Silva, G.L.D.I. (2019). "A Study of Finding Choice Modle for Class-Wise Railway Passenger Demand for Sri Lanka Railways," *Transport Reserach Forum*, pp.47-49.

Hamed, R. E. (2023). "Sustainable Energy Production Solutions in Railway Stations," *Journal of Survey in Fisheries Sciences*, 10(3S) 5416-5434, 2023.