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Website: Kjar.spu.edu.iq | Email: kjar@spu.edu.iq

Measuring Service Quality of Bus Services in Sulaimani City

Niyan Hussein Ibrahim
City Planning Department
Technical College of Engineering
Sulaimani Polytechnic University
Sulaimani, Iraq
Niyan.ibrahim@spu.edu.iq

Rozhen Kamal Mohammed-Amin
City Planning
Technical College of Engineering
Sulaimani Polytechnic University
Sulaimani, Iraq
Rozhen.mohammed@spu.edu.iq

Alan Faraydoon Ali
Presidency
Sulaimani Polytechnic University
Sulaimani, Iraq
Alan.ali@spu.edu.iq

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ABSTRACT

This research paper presents a descriptive model to assess the quality of bus services by measuring passengers' satisfaction in Sulaimani city. Transportation facilities are enlivening the economic activities of any country. Public transportation services are an important aspect of any urban transportation system, as they provide mobility for a number of passengers to different destinations in different directions at the same time via one transportation facility. Public transportation is considered a sustainable mode of transportation. This study intends to assess the services' quality and identify the challenges to sustainable development in public transportation in order to achieve sustainable development for the current public transportation system. A passenger survey was conducted in order to assess the level of service quality including 300 participants. The study depends mainly on the passengers' survey, as well as interviews and personal observations for data collection. SPSS software and GIS are used for Data analysis. The results show the outcomes of the assessment process of the current system based on passenger's opinions. The results reveal the system's aspect in detail which is further clarified in the conclusion. The paper recommends several steps to be adopted in order to improve the current public transportation system in Sulaimani and other cities, it also suggests future studies that can integrate with this study and contribute in achieving its goal.

1. INTRODUCTION

Public transportation is a sustainable and cost-effective mean for mass movement. It comes at various types, shapes, and systems. Bus system is one of the most adaptable forms of public transportation [1]. Bus system is known for its flexibility of serving throughout the needed access of an urban area [1]. Bus services can be used in solving several transportation issues, such as unaffordable fare of private car ownership, or a taxi for urban residents in need for daily commuting to work and/or leisure [2]. Bus services also help with minimizing and controlling traffic congestion and the number of cars in crowded cities and towns [2]. With worldwide growing population and urbanization, developing or expanding sustainable transportation systems have become a global necessity, [3],[4]. The complexity and multilayer nature of public transportation development (including reliable bus systems) and maintenance require extensive planning and continuous performance assessment [4], [5]. Assessing the sustainability of existing or proposed public transport systems has increasingly drawn global attention in the last few years [6]. Some countries have even started to set benchmarks and standards for further development of their public transportation systems sustainably [4], [5] and [7]. Unfortunately, such studies in Kurdistan Region of Iraq (KRI) are still limited in scope and depth.

Like many other cities around the world, increasing population, rapid urbanization, improved income, and significant demand for private car ownership and daily use are threatening the living quality and sustainable development of the cities in KRI, including Sulaimani city [8], [9]. In Sulaimani, like in other KRI cities, bus system was and still is the only available mode of mass transportation. This system, however, barely contributes to solving the many transportation issues the city encounters like traffic congestion, environmental pollution, poor safety on-road, and other related issues. The poor condition and quality of this bus system combined with improved personal income, low fuel price, lack of sustainable urban planning policies (including transportation taxes and low price parking) are negatively affecting the use of public transportation for daily uses in the city. Lack of regional transportation planning and under-planned or random urban design and road projects are further aggravating the state of public transportation in the city and across the country. Sustainable public transportation can take different forms and shapes and at different levels [10], [3] such as buses, bus rapid transit (BRT) trains, light rail transit (LRT), or metro. This paper intends to contribute in covering the lack of knowledge in the literature by assessing the sustainability performance of bus system in the city of Sulaimani. Due to the scope of the wider research and page-limitations in this paper, the assessment focuses on and reports the results from a comprehensive passenger satisfactory survey, which was carried out with 300 passengers from 3 bus lines across the city. In addition to assessing the bus service quality in the city, the research identifies the sustainable development challenges and potentials of the current bus system and contributes to the development of the sustainable guidelines and measures in the public transportation of the region and the country.

2. LITERATURE REVIEW

Performance measurement refers to the assessment of an organization's outputs in terms of managing its internal resources and operation in the environment to achieve the success and durability of the organization [10,11]. Eboli & Mazzulla [10] argue that the performance measurement of public transportation helps in reaching many aims of the transportation systems; it helps with evaluating the overall performance of a public transportation system and its management. It can also help in diagnosing problems with balancing costs and providing service [10].

Service refers to "an activity or a series of activities that take place in interaction with a contact person or a physical machine which provides customer satisfaction" [12] Customer satisfaction is, therefore, a key concern to the success of any service. Customers' requirements for higher standards goes-hand-in-hand with providing a higher quality of service. Decline in provided

service leads to declination in customer satisfaction. Customer satisfaction is important because it produces profits and contributes to market share generation. Scholars like Susniene discuss the importance of travel speed and other services for making public transportation more competitive than private vehicles [13].

Passengers travel mode choice is mainly affected by the quality of bus services, which is an important part of urban public transportation [14]. Evaluating passenger's expectation of the service quality is; therefore, important to determine the bus service quality. For example, while studying the rise of private car ownership in Indonesia, Budiono [15] suggests assessing public bus services through passenger satisfaction. Many service quality elements can be contextual and differ from a context to another [12], [14], and [2]. Service quality is considered as the comparison between customer expectation and perception of service. To determine and evaluate passenger satisfaction [15], Weng, et. al. [14] used an indicator system to understand the passengers' perception. Their study used a questionnaire to analyze the indicators and construct service quality indexes that include timeliness, safety, convenience, comfort, reliability, and economy. These indicators are composed of two levels; the first level includes six upper-level indexes that are divided into twenty-one lower level indexes. The study of Ellis [12] categorizes the same attributes into five main elements of tangibles, reliability, responsiveness, assurance, and empathy. Each of these five elements is then quantified by several factors [12]. In Budiono's study [15] four main attributes are identifying for service quality of the public bus system. The attributes are reliability of the bus transport system, treatment by employees, simplicity of information, and design. The study used a self-rating questionnaire to find out about passengers' satisfaction with the busy system. The questionnaire collected perception data about several quality factors that are divided into two main groups of soft and functional factors. The quantitative data analysis observed a low satisfaction about public bus services mainly due to frequency, comfort, security on buses, and travel time factors [15]. The findings from the study also indicate that functional factors (including frequency, punctuality, price, and travel time) are considered to have a bigger impact on customer satisfaction than soft factors (security issues and comfort). Accordingly, the study recommends giving more attention to the functional factors to increase the use of public buses. This customer satisfaction study was further verified by being applied to two other different cities and being ended with similar results [15].

The study of Li et. al, [16] evaluated bus routes operation performance based on data envelopment analysis. In their study, four main key indexes were used: average running speed, average dwell time, service reliability, and passenger load rate. Among the models for evaluating public transportation operations such as the analytic hierarchy process (AHP), back propagation artificial neural network, fuzzy evaluation, and Data Envelopment Analysis (DEA), the study has used the DEA to evaluate the performance of public transportation operation [16]. The authors' justification for applying the DEA model is due to the nonparametric nature of the model, which enables easy and objective measurement.

The study of Weng et. al, [14] uses 21 indexes from field survey questionnaires to collect data from 3012 passengers on 100 different bus lines across Beijing to determine passengers' satisfaction level. The study first tested the indicators for their reliability and validity and then introduced a model for evaluating satisfaction, which was weighed by the related coefficient. In addition to assessing the indicators, the study also analyzed demographic information. Qualitative passenger opinions were also used to further examine and interpret results from the quantitative analysis. The results showed that 70% of the passengers are satisfied with the service with a satisfaction rate of 78.2%. In addition to the results from the case study, the study also methodologically added to the literature as it contributed to normalizing performance evaluation for public transportation, which can then enhance the sustainable development of bus systems [14].

The studies of Baharum et. al. and Sinha et. al. [17] and [18] consider the quality of service as a sustainability dimension that helps in the process of decision making and identifying policy challenges within the three traditional sustainability dimensions which are environmental, social and economic. The sustainability model in this study of [17] assesses passengers' satisfaction according to the travel experience. The assessment used accessibility, reliability,

responsiveness, physical facilities, safety and security, understanding, environment, image, time, and fare indexes as indicators. Over 100 bus users participated in the survey. Qualitative methods such as observation, photo-taking, and analysis, and interviews were also used for further analysis of the quantitative results. Statistical T-test was performed and the top five rated indexes by the passengers were identified in addition to analyzing the provided services. Results from the study show that passengers' satisfaction is affected by demographic and trip characteristics [17]. The method of this study is useful in determining the existing service quality and identifying the required improvement.

3. METHODOLOGY and DATA COLLECTION

Assessing the quality of public transport means enables improving their quality and eventually increasing the numbers of their users. In assessing bus service quality, customer's satisfaction is considered the best method because it helps with clear identification of any deficiency in an existing bus system [19]. Passenger surveys are important tools for local transport entities for planning and marketing purposes. This is mainly because transportation mode choices and patterns can vary according to passengers' demographic variables such as gender, income, age, and occupation [20]. Studies show that different people make different perceptions in similar situations. To identify public bus service perception, it is, therefore, necessary to collect and analyze relevant insights and concerns directly from the passengers. Passenger refers to any person who uses any vehicle to reach a specific destination without holding any responsibility toward the vehicle or the road [21].

To assess the quality of service provided by public bus transport in Sulaimani city for this study, a comprehensive passenger questionnaire has been conducted. The questionnaire collects three main types of data: passengers' demographic information, trip characteristics, and passengers' preferences. Part of the questionnaire and on-site observation collected both qualitative and quantitative data for a total of 14 attributes from five major first-level elements for service quality: tangibles, reliability, responsiveness, assurance, and empathy. Table 1 summarizes the five major first-level-elements and their associated second-level-attributes [12].

The categorical and 5-point Likert scale questions collected data about the quantitative attributes, while the open-ended questions collected data about additional qualitative attributes. The Likert scale questions helped with measuring the degree of participants' feelings or attitudes towards the attributes. The categorical questions were useful to collect data about the attributes that were collected through direct observation of the authors or did not exist in the local context. The questionnaire randomly collected data from a total of 343 users in three sublines (Rizgary, Twi-Malik, and Qalawa) of three bus lines (Rizgary, Twi-Malik, and Shekh Mhedin). Although the sample size is relatively small for a city with a population of over 768,058 people due to scope and time limitation, to our best knowledge, the results from this study are the first systematic investigation and in-depth documentation of passenger's perception on service quality of the local bus lines in the region and the country. These results can well inform and guide future research design and interpretation in Kurdistan Region of Iraq and similar context. The targeted three bus lines are all located within Malik Mahmood ring road due to data availability, access, and some other research design considerations. In choosing the sublines, we aimed for three different route directions and geographic reach from the main station in the city center as well as three different socioeconomic levels [22] and [23]. The passenger questionnaire was conducted in the course of a week from July 8th to July 15th, 2019. The Questionnaire included a range of categorical and 5-point Likert scale questions. The first part of the questionnaire included demography questions, while the second part of the survey included questions related to the passengers' usability behavior and motivation for using the bus service. The last part of the questionnaire collected data about the participants' perception of the quality of the bus service and trip characteristics.

Copies of the questionnaire were distributed in the bus stations and stops (during waiting for departure) or inside the buses (on-board), depending on the respondents' preference. The later (onboard data collection) is considered the most accurate data collection form for passenger surveys [19]. Although the questionnaire was designed to be self-completed, sometimes it was

conducted through interviews due to the various levels of literacy skills among the respondents and to increase the accuracy of the data collection.
To increase the accuracy of the collected data, 43 incomplete questionnaires were discarded. As a result, data from 300 respondents (100 respondents from each subline) were entered and analyzed by the SPSS software. To verify and better analyze the bus service quality, in addition to passengers' responses, we also carried out semi-structured interviews with public bus service-related departments, decision-makers, and stakeholders. During the interviews, secondary data such as the number of buses, bus stations, bus stops were obtained. We also collected data about taxes, bus fees, bus line directions, service zones, and numbers set for each line during these interviews. During the interviews, we also collected qualitative data about the thinking, attitudes, and plans of the decision-makers towards public bus conditions inside Sulaimani city. Due to the quantity of collected data through different methods, scope, and page limitations, in this paper, we only report results from the passenger survey and some of the interview responses.

Table 1: Service quality attributes and measurement method. (Source: Authors based on [12])

No.	First level	Second level	Measurement
1	Tangibles	Bus stop condition	Likert
2		Comfort while seating	Categorical
3	Reliability	Walking distance	Likert
4		Waiting time	Likert
5		Punctuality	Likert
6		Ticketing system	Categorical
7	Responsiveness	Complaint handling	Categorical
8		Crew service	Likert
9		Readiness to help	Categorical
10	Assurance	Safety	Likert
11	Empathy	Information system	Categorical
12		Accessibility	Likert
13		Comfort level inside bus	Likert
14		Affordability	Likert

The demographic data analysis in Table 2 shows that the sample is (almost) equally divided between males and females. Therefore, the opinions of none of the two genders are dominant in the questionnaire. The vast majority of the participants (over 65%) ages between 18 and 40 years old. Only 7.7% of the participants are under 18.
Less than half of these bus users have had any post-high school education. The majority of the participants are employed (in government or private sectors) or had freelancing works. A total of 97% of the bus users are residents of the city. Of these, 70.7% are born and raised in the city. The low use of buses by new or non-residents may be due to unfamiliarity with or unreliability of the bus services in the city. Only 35% of these bus users owns car. This implies the limited use of public transportation by car owners in the city.

Table 2: The participant's demographic data. (Source: Authors)

Demographic Data	Categories	Percentage
Gender	Male	50.7%
	Female	49.3%
Age	under 18	7.7%
	18-25	30.3%
	26-40	39.3%
	41-50	13.7%
	51-60	5.7%

	60 and above	3.3%
Education level	Non or primary	15.3%
	Middle school	18.3%
	High school	25.0%
	Diploma	3.3%
	Bachelor	36.0%
	Graduate Degree	2.0%
Employment Status	Student	9.7%
	Unemployed	30.7%
	Working in public sector (government)	22.0%
	Working for private sector	18.0%
	Freelancer	19.7%
Years living in Sulaimani city	Since I was born	70.7%
	Up to one year	4.0%
	Less than five years	1.3%
	Less than ten years	3.7%
	More than ten years	17.3%
	I do not live in Sulaimani	3.0%
Car Ownership	Yes	35.0%
	No	65.0%

Geo-location of the participants' residential neighborhood concerning the subline they used during the data collection indicates that the majority of the respondents use the corresponding subline (and possibly public transportation in general) to directly travel between their resident location and city center (a pre-dominantly commercial part of the city). This shows the concentration of the respondents' residential location in or near the subline in which the data collection was carried out. The residential neighborhood of a small number of respondents located outside the coverage area of the subline they used during the data collection (see Figure 1).

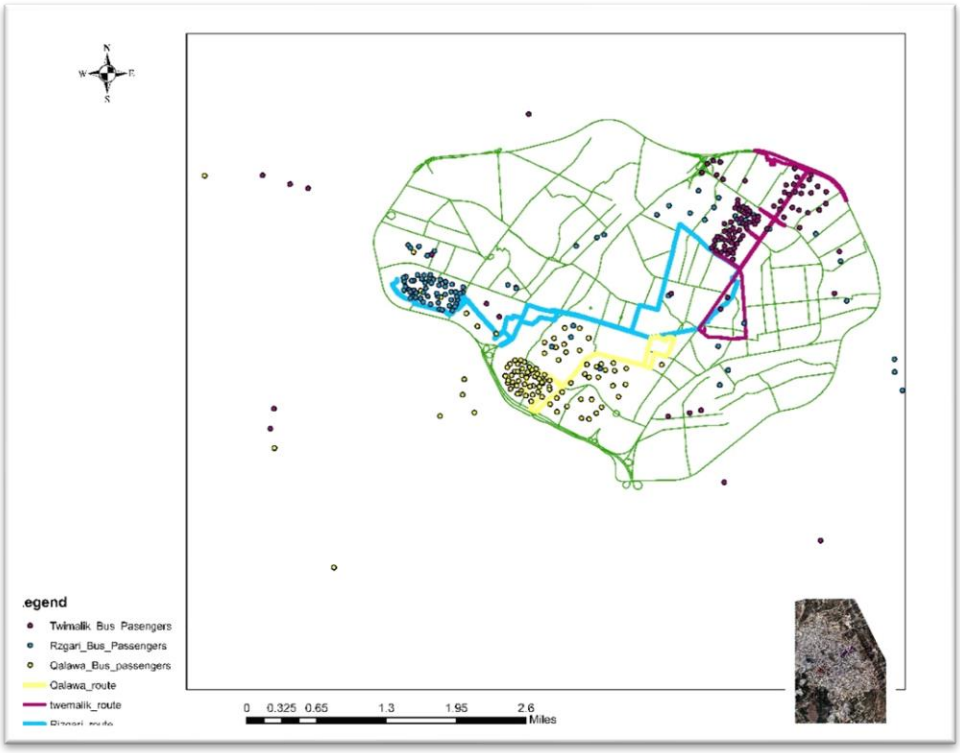

Figure 1: Geo-location of the respondents' residential neighborhood (Source: Authors)

4. RESULTS AND DISCUSSION

Questionnaire's answers reveal that nearly half of the participants use the buses daily (32 %) or 2-3 times per week (17%). The rest are occasional users, including once a week as well as other miscellaneous frequencies that are not specified in the questionnaire (Figure 2). This can be related to the fact that %40 of the participants are employees in either the government sector or the private sector. While another %9.7 of the participants are students. In which both categories of participants have daily trips to conduct. The majority of the participants (56%) are long-term users of the buses. Only 7% of the patricians are new users of buses. Using the buses only since working and/or studying has been reported by 13% of participants. This can be further clarified by the fact that the majority (%70.7) of total participants have lived their whole lives in the city. 21% of the participants recalled using the buses occasionally and not for a long time. While only 3% checked the 'others' option which refers to the other durations that are not particularly mentioned in the questionnaire (Figure 3).

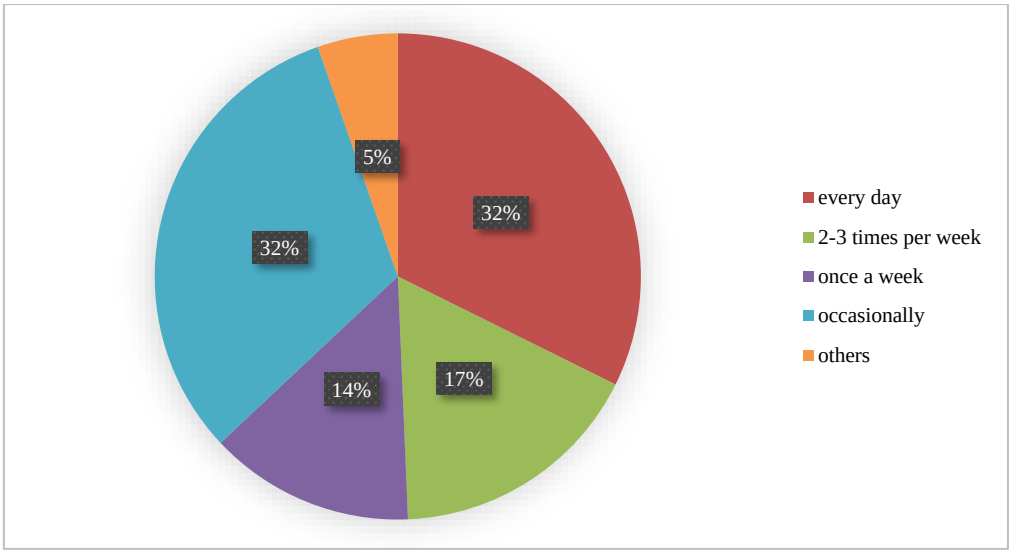

Figure 2: Participants' Regularity of bus use. (Source: Authors)

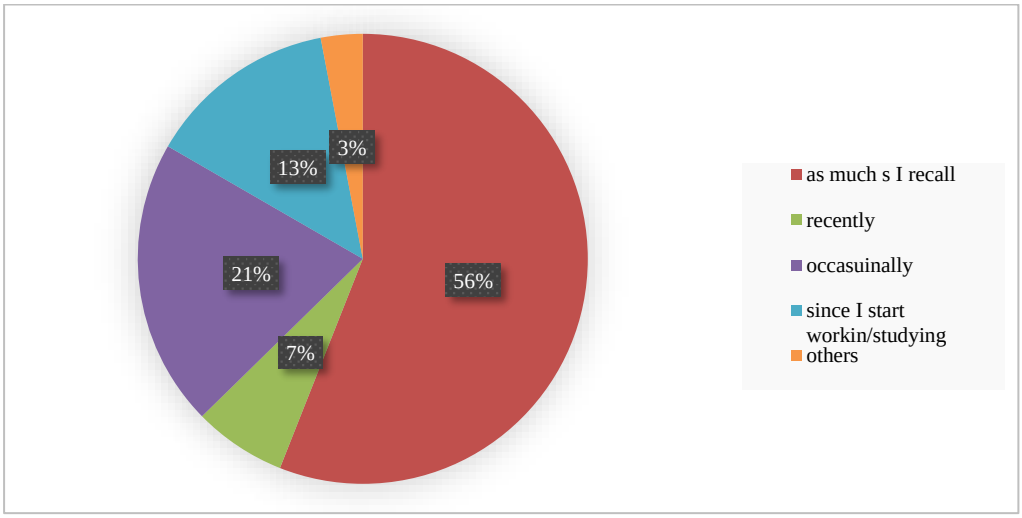

Figure 3: Participants' familiarity of bus by (Source: Authors)

Half of the participants selected shopping as the main purpose of using buses (Figure 4). This is not surprising considering the buses' destination; the city center. The use of buses for shopping was also observed in the participants' residential neighborhood geo-location, which was discussed earlier (figure 1). The vast majority of the participants from the three sublines (70%) reported that they are regular users of buses. This high percentage is inconsistent with the participants' previous answers to the multiple-choice answer about the frequency of using the buses.

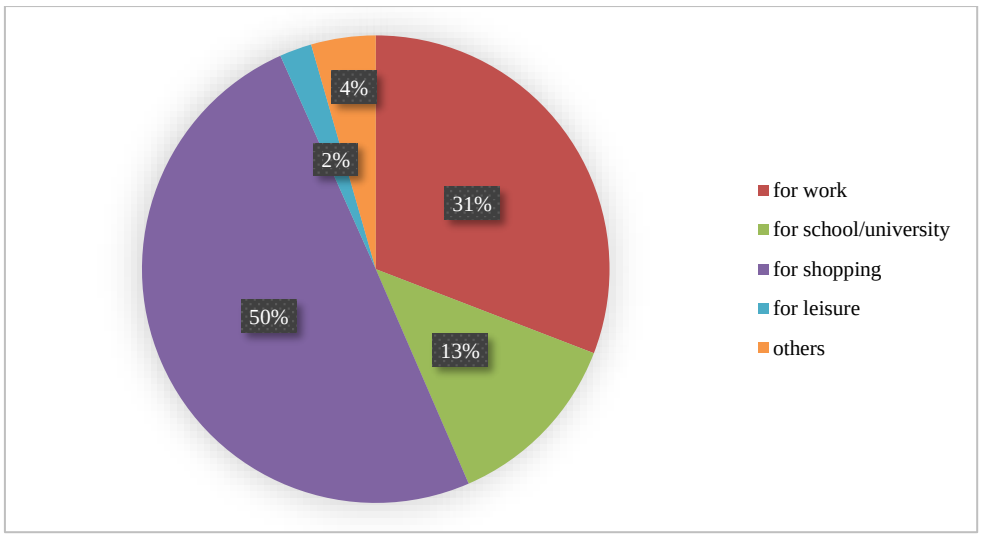

Figure 4: Participants' purpose of bus use. (Source: Authors)

The vast majority of participants selected low bus fare (43%) and (34%) of them chose convenience as answers for the main reason for using buses. Other participants' answers include; not having a private car (19%) and environmental concerns (2%); the rest (2 %) referred to other reasons without elaboration (Figure 5). These answers indicate low environmental prioritization among the participants.

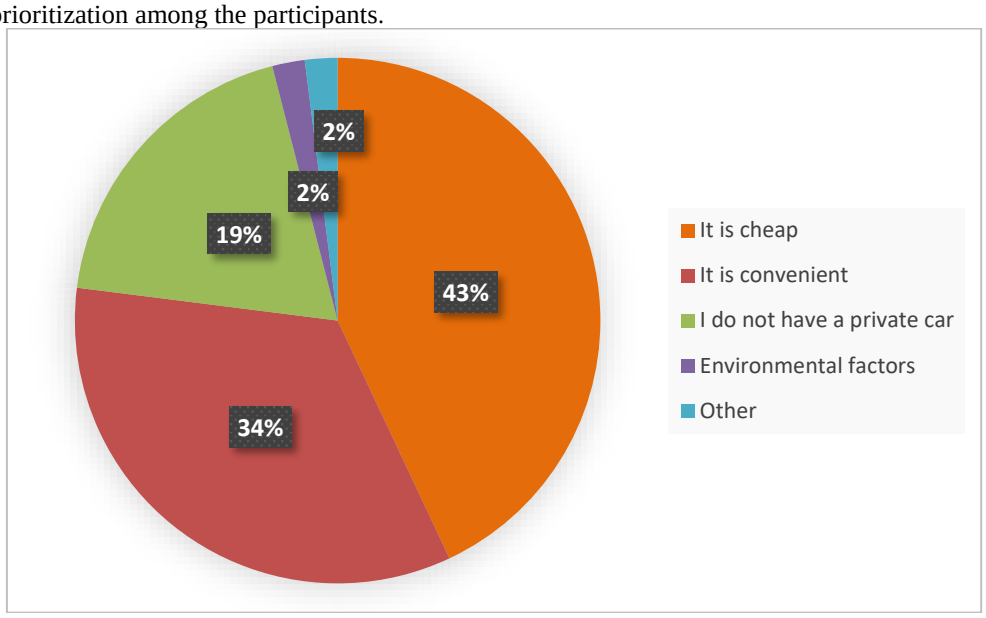

Figure 5: Reasons for using buses. (Source: Authors)

The assessment of the bus service quality in the last part of the survey shows that the average ratings of the nine attributes of the first-level-elements are over 3 on the scale of 5, suggesting an overall medium satisfaction with the bus service quality by the participants. The reliability element composed of; walking distance, waiting time, and punctuality attributes, achieves the highest average rating (3.9) Within reliability, walking distance has the highest average rating (4.31), while punctuality has the lowest average rating of (3.39). Still, the average ratings of waiting time and punctuality appear to be high considering the lack of the written and non-written bus schedules in the local bus stations see table 3 for the attributes measured via Likert

scale and table 4 for the attributes measured via categorical questions. The majority of participants may have contributed to this high rating due to being accustomed to low expectations. Empathy service quality element ranks the second-highest average rating, while the tangible element has the lowest average rating among the five assessed service quality elements (Figure 6).

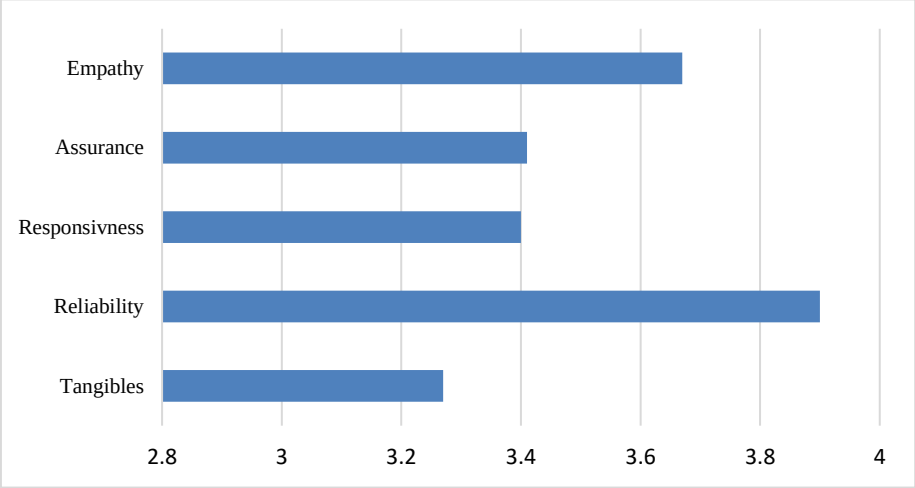

Figure 6: Service quality attributes scoring. (Source: Authors)

Table 3: Service quality for the attributes measured by Likert scale questions (Source: Authors)

No.	First level	Second level attributes	Measurement	Mean	Range
1	Tangibles	Bus stop condition	Likert scale	3.27	Medium
2	Reliability	Walking distance		4.31	Good
3		Waiting time		4.02	Good
4		punctuality		3.39	Medium
5	Responsiveness	Crew service		3.4	Medium
6	Assurance	Safety		3.41	Medium
7	Empathy	Accessibility		3.6	Medium
8		Overall comfort level inside the bus		3.39	Medium
9		Affordability		4.02	Good

Table 4: Service quality for the attributes measured by the categorical questions (Source: Authors)

No.	First level	Second level attributes	Measurement	Yes	No
1	Empathy	Information system	Categorical qustions		√
2	Responsiveness	Readiness to help			√
3	Responsiveness	Compliant handling			√
4	Reliability	Ticketing system			√
5	Tangibles	Comfort while seating		√ (%68)	√ (%32)

Within the rated nine attributes (see Figure 7), walking distance and affordability collect the largest number of 5 ratings (very good) and a smaller number of 2 (bad) and 1 (very bad) ratings,

followed by waiting time attribute. The bus stop conditions, punctuality, crew service, and overall comfort level inside the bus have more neutral or negative (bad or very bad) ratings. There is more division in rating among the participants for accessibility and safety attributes. Feedback from the bus drivers and participants (verified with our observation) revealed that four (Information system, Readiness to help, Compliant handling, Ticketing system) out of the remaining five attributes are missing in these three sublines (and all the bus lines in the city). In the survey, %68 of the participants across the three sublines agreed on the seat comfortability (Table 4).

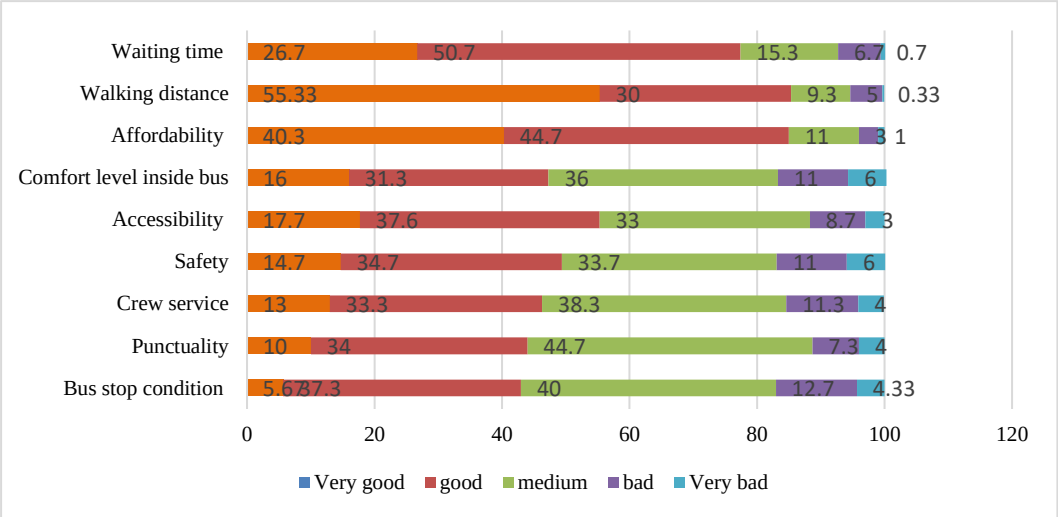

Figure 7: Participants' satisfaction regarding the nine attributes. (Source: Author)

In addition to the 14 targeted attributes, the survey also collected the participants' open opinions on the negative and positive aspects of the bus services in Sulaimani and their suggestions for improvements. As it appears in Figure 8, half of the participants (in various wordings) referred to the high level of crowds in buses as a negative aspect. Buses' condition and on-board condition was the second negative aspects of the bus services with its identification by 24% of the participants. This open response, to some extend, is inconsistent with the unanimous agreement on the seat comfortability in the categorical (yes or no) question in the survey. The other mentioned aspects such as price, safety consideration, coverage area and service hours, irregularity, and inappropriate bus stations and stops are identified by a much lower number of participants ranging from 1 to 4%. 8% of the participants did not identify any negative aspects. Figure 9 shows samples of bus stops' and bus stations' condition, while figure 10 shows the situation inside typical buses.

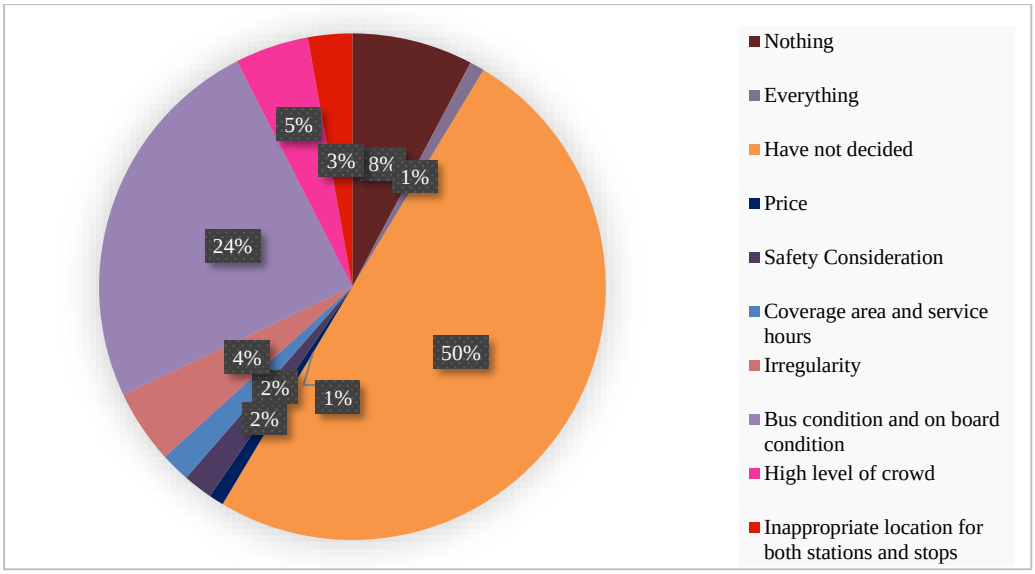

Figure 8: Participants' opinion about negative aspects of the bus service (Source: Authors)

Figure 9: Bus stop (Alwand street) and bus station condition (Twi-Malik bus station) in Suleimani (Source: Authors)

Figure 10: Condition inside bus, and comfort level (Source: Authors)

Most of the participants (51%) could not think of or were undecided about any positive aspects of the bus services, suggesting a non-positive overall impression of the bus services. This contradicts the overall medium satisfaction with the bus service quality that appeared in the average ratings in nine attributes in the rating questions. Emotional or social pressure by some participants in responding to the rating questions may have contributed to a higher rating [24]. At a ratio of as little as 12% and 10%, affordability and Accessibility, availability, and reduced travel time were identified as the top two positive aspects in the bus services by the participants, respectively (Figure 11). 7% of the participants referred to "everything" as positive aspects of the bus services, while an equal ratio identified "nothing". Only 1 to 2% of the participants identified the quality of buses, bus stops and stations location, reduced congestion and comfortability on board, driver's behavior and social respect, and safety and security as positive aspects (Figure 11).

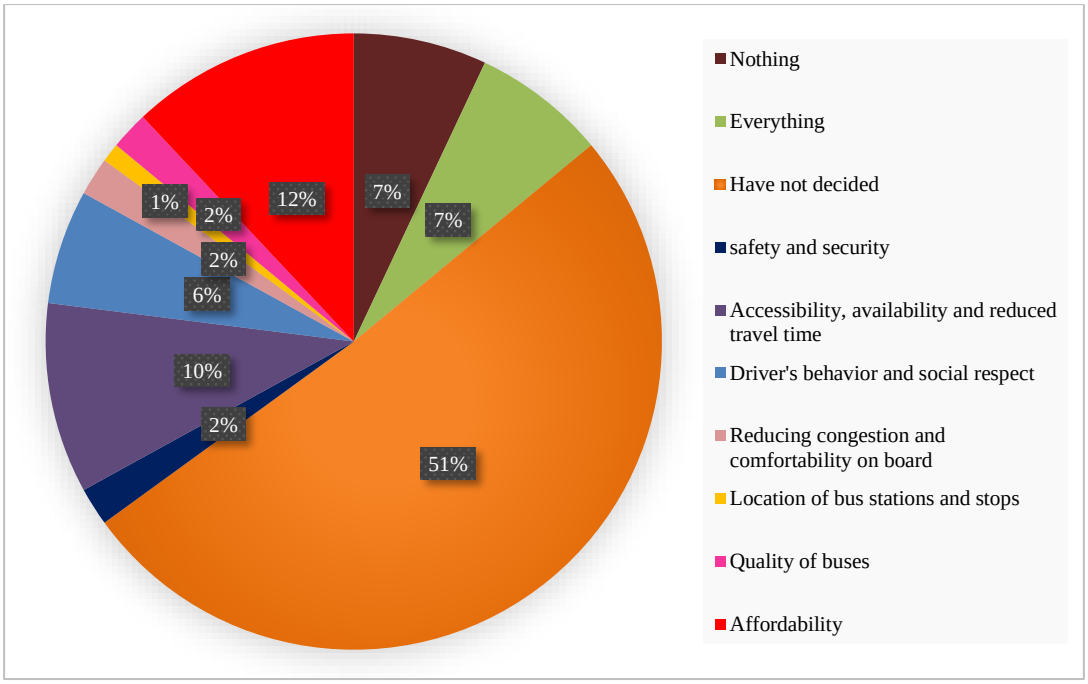

Figure 11: Participants' opinion about positive aspects of the bus service (Source: Authors)

The vast majority of the participants (86%) suggest an improvement in the bus quality (Figure 12), while only 5% of the participants suggest regulating headways and the number of passengers for departure. Within the local buses' operation context, this suggestion helps with improving bus departure and arrival timing (reliability) and regularity. This suggestion and the absence of other suggestions for regulating the time, reveal the lack of the participants' awareness about other ways for regulating bus timing (such as schedule-based bus operation) that is common in bus operation in developed countries. Other suggestions at much smaller percentages include regulating bus line and dedicating bus lanes, including passenger information system PIS, increasing service hours and including new bus lines, increasing bus drivers' awareness about the provided services, improving bus stations and stops, including the ones of the private sector, and developing a ticket system (Figure 12).

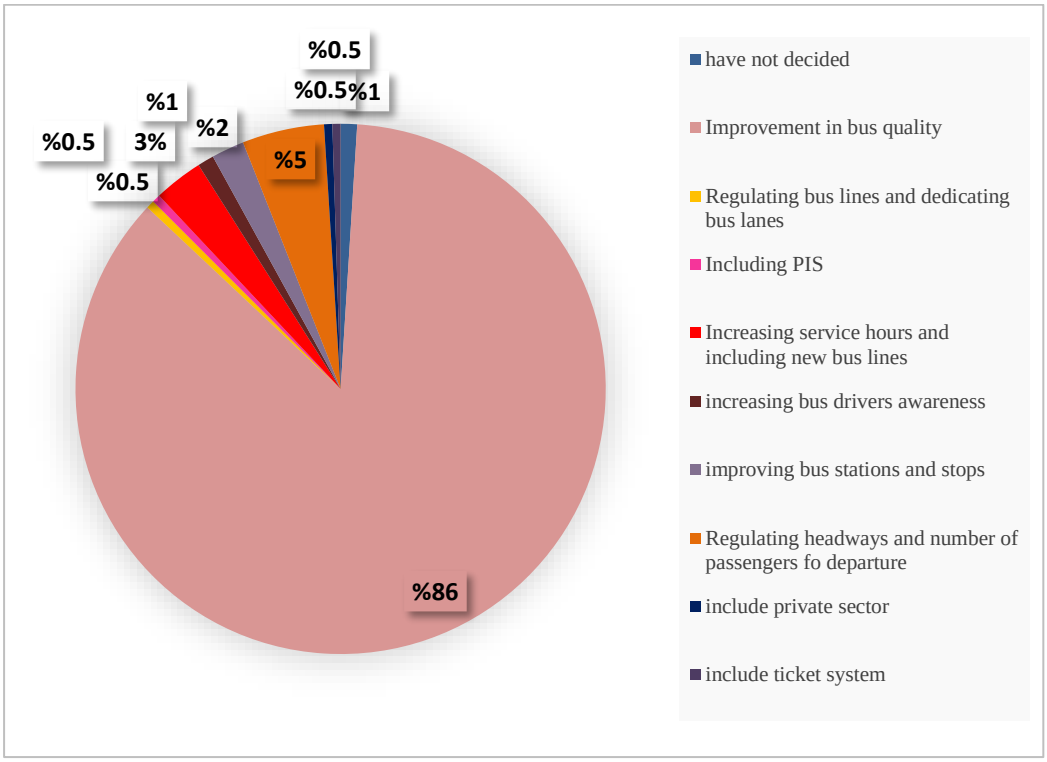

Figure 12: Suggestions made by the participants to improve bus service (Source: Authors)

5. CONCLUSION

Bus service is an important tool for sustainable development in urban areas. Enhancing the quality of bus services is an important way for not only keeping existing bus users but also attracting new users who can contribute to reducing the number of private vehicles on roads. In this paper, we presented our assessment for the bus service quality in three sublines as a case study for bus services in the city of Sulaimani. Our observation from this preliminary baseline study is that the bus services in Sulaimani are not in good condition and those bus users in Sulaimani seem to be inexperienced with what is considered globaly as good bus services. This does not appear from the responders' direct response to the survey questions, but rather due to our interpretation of their low expectation of what "good" bus services should look like. The very few complaints about the absence of the essential services of ticketing systems, compliment handling, readiness to help and information system is an evidence that supports that interpretation. We also noticed that passengers' travel means choice is mainly affected by the quality of that means services. The second part of this research explores the stakeholder and decision-makers' insights and plans on bus service quality in Sulaimani. More research also needs to be undertaken; especially those that are related to objective measurements of bus services in comparison with bus services in developed countries to determine the quality of bus services of Sulaimani. Investigating more bus lines with different destinations and more passengers are also essential for drawing an accurate generalization about bus line service quality in Sulaimani and similar context within the Kurdistan Region and the rest of Iraq.

6. RECOMMENDATION

1. More systematic investigations and assessments for bus service quality and other aspects of public transportation in the context of Sulaimani and other cities in developing countries need to be carried out for developing informed sustainable public transportation strategies, policies, guidelines, and interventions.

2. Undertaking more studies on infrastructure, administration, operation, services, and funding of existing public transportation systems and investigation on best practices in sustainable public transportation development and management from around the world and similar context.
3. Simple, but essential, upgrades and improvements like developing passenger information system, ticketing system, and bus route maps as well as changing passenger number-based operation to time-based one can contribute to big improvements in the bus service quality in Sulaimani and increase the use of public transportation.
4. Exploiting new technologies (such as GPS and CCTV camera) for tracking, monitoring, and assessing various aspects of bus services and informing the improvement of service quality.
5. Undertaking regular passenger satisfaction surveys and involving and consulting the local community with the development of new bus lines and services in the city.

7. FUTURE RESEARCH

In addition to assessing service quality of the local public transportation system in Sulaimani through measuring the passengers' satisfaction towards14 attributes, the scope of this study can be expanded through the inclusion of other attributes and sublines in the city. Future studies can collect and analyze additional qualitative and quantitative data with a larger number of passengers across different bus lines in the city. Interview and focus group with related authorities, decision-makers, and other stakeholders will also help with deepening the assessment of bus service quality and overall public transportation system in Sulaimani and other cities with similar context.

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