

Multicriteria Evaluation of the Quality of Service of Informal Public Transport: An Empirical Evidence from Ibadan, Nigeria

Abstract

Developing countries experience a decline in bus public transport investments. Yet informal public transport has continued to grow rapidly. Previous studies have evaluated the Quality of Service (QoS) provided by such informal transport but a multi-criteria evaluation that considers various stakeholders in the Global South is missing. A case study was carried out in three local government areas in Ibadan, the third largest city in Nigeria, with a focus on identifying criteria to develop an evaluation model for QoS.. Information on user perceptions of the identified QoS criteria was collected through the administration of questionnaires onboard and offboard, using stratified system random sampling. Weights of the variables for the determination of the QoS of the IPT were determined from stakeholder focus groups. Weights were assigned to each of the observed variables of the set criteria, which serve as indicators for the assessment of the quality of service. The multi-criteria included accessibility, affordability travel, waiting time, travel time, seat comfort, transport fares, safety, and the drivers' attitude. Findings from the application of the multi criteria evaluation model indicate an all-round low quality of service to all criteria applied. In particular, the study observes a low accessibility of informal transport service in Ibadan compared to other similar studies. The poor service quality experienced make the transport cost considerably unaffordable (value for money) given low quality in-bus comfort due to poor seats and crowding at terminals and in bus, low safety standards due to road unworthy buses, long travel time due to delays at loading terminals and undesignated frequent in passenger pick and drop points, and experiences of aggressive and reckless drivers. This paper advances new understanding in two arenas: firstly, that informal public transport has positive contribution to the Nigerian economy in general but needs policy support for strengthening its resilience; secondly, a new methodology, the multi-criteria evaluation model that was developed in this paper has potential for transferability in the evaluation of the quality of service of IPT. This is because the model although showed that QoS of IPT in the case study area of Ibadan is low however has demonstrated its ability to integrate range of criteria that are context-specific, for assessing the QoS of public transport.

Keywords: Multicriteria, Perceptions, Quality of Service, Informal Public Transport

1.0 Introduction

The quality of service (QoS) of public transport and its accessibility play a major role in countering the growing use of cars globally, as urban dwellers' needs for mobility increase. The major cities of developing countries such as Lagos and Ibadan in Nigeria, Accra in Ghana, and Delhi in India are burdened by the lack of capacity of available public transport to service their increasing populations (Pucher & Korattyswaroopam, 2004; Godard, 2006; Venter, 2013). Notably, as demand for public transport increased its QoS degenerated, partly contributing to the increasing use of private cars in those cities. The diminishing bus public transport in the face of increased demand due to population growth was increasingly characterised by shortages of public transport buses, their increased unreliability in scheduling and consequent overcrowding of passengers, thus leading to the degeneration of QoS in formal public transport. Improvement in the quality of service (QoS) of bus public transport is widely accepted as an approach that can largely attract current and potential users towards using bus services (Guillen *et al.*, 2013). An enhanced QoS encourages a modal choice shift from private car ownership to bus public transport services in the cities of developing and developed countries (Redman *et al.*, 2013). Currie and Wallis (2008) prove that the strategy of enhanced QoS attracts passengers to use of public transport.

While a significant improvement in the QoS of public transport in the cities of the developed world has been recorded, as evidenced in the infrastructure, operations, and services, little is achieved in most cities of the developing countries such as in Ibadan, Nigeria, and Nairobi, Kenya. Consequently, such decline in public transport investments led to the emergence of informal transport to meet the travel demand in urban areas. Informal transport is described as a market-based, unregulated, and low capacity service with some levels of coordination mostly from the operators (UITP, 2010, CDIA, 2011, UN-Habitat, 2012). Informal public transport (IPT) remains the dominant public transport service in developing countries and has been perceived as both a resource as it meets transports demand for the poor urban population and a problem in that it is generally considered as an illegal operation by most regulatory authorities in major cities as its operations are not entirely regulated by formal governing institutions. The dominance of IPT in cities of Africa varies in size and modes: for example, from fifty-two (52) percent of all public transport trips in Cairo (Egypt) to ninety-five (95) percent in Dakar (Senegal) (Godard, 2006). The key elements which are referred to as a resource or a problem also directly or indirectly constitute the major factors for the assessment of QoS. The service infrastructure used by IPT and the vehicles used are considered a useful resource by the operators and the users but at the same time they are the sources of problems related to perceptions of comfort, safety, and reliability. Thus, it is pertinent to evaluate the QoS of IPT to give policy direction on public transport in cities of developing countries, through exploring the perceptions and expectations of the users.

The objectives of the study are to review the criteria used in the evaluation of QoS of informal transport service and to develop a multi criteria-based model for the evaluation of the QoS experienced by users in three Local Government Areas of Ibadan. As a case study, in depth methods of data collection, analysis and model development are adopted into an integrated range of weighted QoS attributes. This study entail considerations of complexities of informal transport, transport user perceptions and identification and adoption of multicriteria of QoS attributes. The findings of the study have implications to policy seeking to enhance the quality of services provided by the growing informal transport sector in the cities of the developing world.

1.1 Background to study area

The case studied three Local Government Areas (LGAs) in Ibadan, which is the capital city of Oyo state located in southwest Nigeria, West Africa. The total land area covered by Ibadan is 3,123 km² (RUAF-CFF, 2007), and it is situated 125.5km inland from Lagos. Thus, it is a prominent transit point between the coastal region and the area to the North (RUAF-CFF, 2007). Figure 1 shows the map of the study area in Ibadan. The focus of the study is the three adjoining LGAs in the centre of the eleven LGAs that constitute Ibadan city: Ibadan North, Ibadan North-West, and Ibadan North-East. The selection of the three study areas was not intended to be representative of the City of Ibadan but was focused on the lived experiences of the users of informal transport in these three local Government Areas as these have a high dependency on the use of such informal transport.

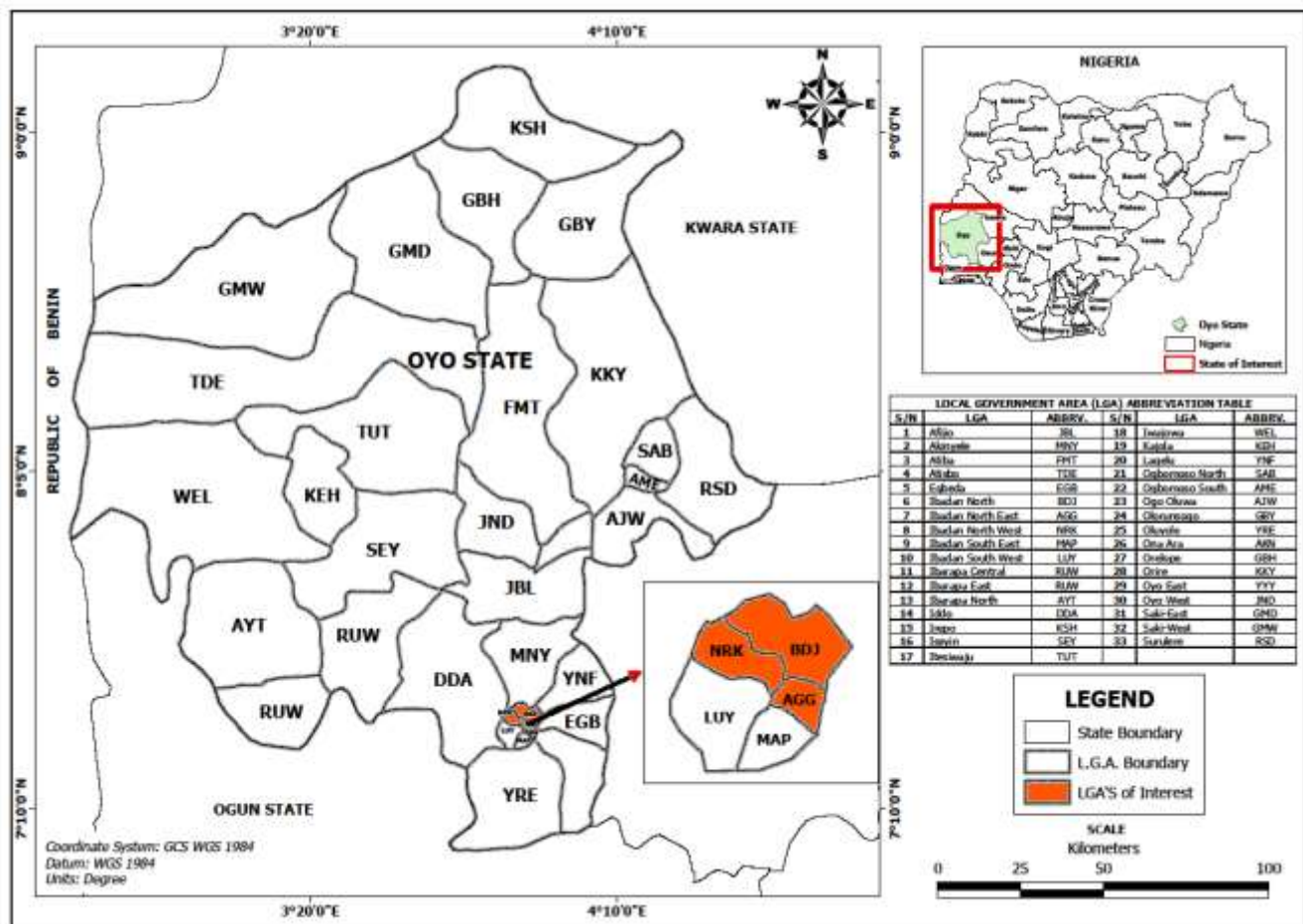


Figure 1: The map of the study area in Ibadan

In Nigeria there are three forms of informal transport, the minibuses of 15-18 passenger capacity, tricycles and motorcycles. However, this study focuses on the perception of users of the minibus (*Danfo*) informal transport services.

This paper is structured as follows: first, a literature review is carried out to characterise informal public transport services more generally, and an assessment review of the quality of service of public transport. Then, the methods section documents how a multi-criteria evaluation model is developed for this study. Following this, key results from the analysis are presented around key themes emerging from the study. The paper concludes by highlighting: (1) how the findings from the study have wider implications for re-examining informal public transport in other contexts; and (2) that the multi-criteria evaluation model developed in this paper is an important contribution to current approaches in assessing the quality of service in informal public transport.

2.0 A Review of Quality of Service of Public Transport Assessment

Wang *et al.* (2010:1104) state that describing and assessing the quality of service (QoS) is hard due to the ‘intangibility, heterogeneity, inseparability and perishability of the service industry’. As a result of the difficulty in defining the concept of QoS, its investigations have been based on wildly different assumptions (Hrelja *et al.*, 2016). The heterogeneity of factors impacting QoS is distinctly more pronounced in informal transport due to its lack of regulation in its operations characterised by flexible scheduling of trips and routes compared to formal transport practices. As such, the scales used for the assessment of QoS in formal transport would not necessarily fit the user experiences of informal transport. In addition, the growing significance of informal public transport in Ibadan requires a more pragmatic approach that encourages turning the negative perceptions of IPF to a positive policy informed by stakeholder perceptions (Moyo and Olowosegun, 2021) hence the significance of multicriteria evaluation of perceptions of their quality of service. Rekhviashvili and Sgibnev (2020) note the need to recognize the socially embedded character of informal transport seriously.

This study will initially review criteria used in approaches to the assessment of QoS to enable framing of assessment criteria for the selected case study areas. From this review, the identified criteria are presented through three typologies: service infrastructure characteristics, features of mode of travel, and user needs. Infrastructure entails the mechanisms and practices that support the delivery of public transport. The features of the mode of travel define the state of the mode of travel in place, whilst user need defines the expectations the users have of the transport service. Collectively, these three typologies of QoS define the transport system in place. A wide range of attributes within such a system is amenable to the influence of planning authorities and transport operators in defining the QoS (Paulley *et al.*, 2006).

2.1 Service infrastructure characteristics

Transport infrastructure and service needs vary among transport stakeholders (Wang *et al.*, 2010). Specific concerns need to be addressed, such as the need for the efficient performance of public transport due to the increased service levels of transport systems in urban areas (Wang *et al.*, 2010; Hrelja *et al.*, 2016). Thus, the nature of infrastructure seeks to establish efficiency in service delivery and influences public perception of QoS.

A study by Mortona *et al.* (2016) suggests that improving the service frequency, availability, reliability, and stability may enhance the perceived QoS and satisfaction of the users. Such infrastructure features shape and influences the architecture that supports service delivery. In addition, Mahmoud & Hine (2016) offer an in-depth explanation of perceived QoS, using indicators such as ease of transfer, service frequency, and availability by the users, like other dimensions of the service infrastructure.

One of the common measures of the QoS of public transport systems or infrastructures used by most transport planners and traffic engineers is the use of the traditional Level of Service (Guillen *et al.*, 2013; Beirao and Cabral, 2007; Hensher, 1998). From a study by Guillen *et al.* (2013), some hypotheses were presented which include how the Socio-Economic Characteristics (SEC) of individuals influence the evaluation of Quality of Service (QoS), as well as the dependency perception and the actual frequency of use of IPT. The evaluation of the QoS influences the perceived dependency and the actual frequency

of public transport mode use (Guillen *et al.*, 2013; Balcombe *et al.*, 2004; Sohail *et al.*, 2003). Also hypothesized is whether there are connections in the QoS between informal public transport and formal public transport modes (Guillen *et al.*, 2013).

The level of service is one of the principal factors that determine the mode of transport that passengers are likely to use. It requires significant systemic effort for public transport to offer an adequate level of service to attract private car users to change to public transport (Hensher, 1998). It is interesting to note that IPT offers a level of flexibility that can hardly be found in formal public transport (Cervero & Golub, 2007). There is a need for public transport service operators to be more market-oriented with the capacity to compete with fellow operators and other modes of transport, and this can be promoted through policies that aim to promote the use of public transport. To achieve this, quality of service improvement is required, underpinned by a clear sense of understanding of travel behaviour, needs, and expectations of the users (Beirao & Cabral, 2007).

Beirao & Cabral (2007) emphasise the significance of measuring the level of service of public transport to determine its potential strengths and weaknesses. This aids the process of evaluation of alternative service enhancement which is aimed at boosting customer satisfaction and increased market share. Nevertheless, it is a complex task to develop precise and valid measures of QoS since it involves perceptions and attitudes. However, possessing an improved understanding of the perceptions of the quality of the public transport service provided to users is essential.

Carreira *et al.* (2014) presented a detailed QoS evaluation by developing a scale of measurement from an in-depth qualitative assessment of user views. The items for evaluating QoS included the dimensions of individual space, information provision, staff skill, social environment, off-board facilities, and ticketing services. Notably, social environment and off-board facilities, and individual space are areas in which an informative comparison can be made in assessing the QoS of informal and formal public transport. In addition, Guillen *et al.* (2013) developed a QoS evaluation framework for assessing the quality of public transport services. This framework included network coverage, convenience, affordability, driver's attitude and personality, safety, and security. Such features define service infrastructure.

According to Parasuraman *et al.* (1988), QoS can be assessed through five constructs, which include: tangibles, responsiveness, assurances, empathy, and reliability. This is SERVQUAL scale-based research that relies on factor analytic psychometrics. Carr (2007) stated that SERVQUAL has made significant contributions to the understanding of QoS, while at the same time showcasing the relevance of reactions of stakeholders to service. It is vital to note that the 'original SERVQUAL' has five dimensions, comprised of 22 sub-dimensions (Parasuraman *et al.*, 1988). Parasuraman *et al.* (1985) developed a GAP framework that consists of five gaps in the identification of the overall QoS. The GAP framework provides a baseline for what is important if organizations are to improve their accountability to stakeholders. It was noted that the number one gap in the framework happens when there is a difference between the expectations of the customers or users concerning service and the perceptions of the

managerial team concerning those expectations. This last represents the QoS which refers to the size and direction that occurred between the perceptions and expectations of the users. Zeithaml *et al.* (1990) noted the challenge for service providers is to identify and capture the precise expectations of users, which is the most essential stage in defining the quality of service.

Identification of the salient properties of QoS, as perceived by both current and potential users based on the service providers' perspective, is essential. Nonetheless, it is a complex task to work out the specification of a set of important attributes (Prioni & Hensher, 2000). It is important to develop an understanding of the three fundamental things that informal public transportation does, which are the creation of flexibility, filling gaps in transportation provision, and serving niches. An understanding of these fundamentals has numerous implications for how people perceive and value both the providers and users of IPT (CDIA, 2011).

More recently, a study of the impact of the use of ICT by operators and users of IPT showed improved perceptions of the quality of service provided demonstrating the positive impact of ICT on the service infrastructure (Medeiros *et al.*, 2018). The reliability of informal transport service is an aspect to be maintained to satisfy service delivery (Amrapala and Choocharukul (2019a, 2019b).

2.2 Features of the mode of travel

Attributes such as vehicle characteristics, modes interchange, reliability of service, provision of information, and related bus specific factors are noted to be more difficult to assess since changes in these normally trigger changes in other attributes, especially transport fare and journey time (Paulley *et al.*, 2006). Mortona *et al.* (2016) carried out a comprehensive examination of the QoS of a bus service based on the users' views of latent factors such as convenience and cabin environment. In their study, Carreira *et al.* (2014) examined perceptions of vehicle maintenance as a factor influencing user perception. In a study to identify service delivery gaps in informal transport, Amrapala and Choocharukul (2019a) note that in-vehicle environment, road safety and customers services influence satisfaction levels. These studies revealed the users considered these features important elements of QoS assessment. Other modes of travel evaluation criteria considered by Guillen *et al.* (2013) in their framework for assessing the quality of public transport services, included vehicle design and features, and vehicle noise and pollution.

2.3 User needs

Increased use of transport services leads to increased concerns for transport QoS maintenance, aligned to changes in the social and economic lifestyles of users (Wang *et al.*, 2010). Policymakers cannot achieve the best results just by the creation and provision of services, without policy-makers considering the stakeholders' views on the quality of such services. This is achieved by efficiently measuring the reactions of the users of the services through valid and acceptable instruments (Wang *et al.*, 2010; Stradling *et al.*, 2007; Carr, 2007). The perception of users or customers on the QoS consists of the technical quality which is the core services assessment; and the functional quality, which is the service

delivery process evaluation (Gronroos, 1984). The social embeddedness of perceptions of such technical and functional quality dimensions needs to be accepted (Rekhviashvili and Sgibnev, 2020)

Several users need attributes revolve directly around time: for instance, access and egress time, service interval, and in-vehicle time. The sense of journey times is thus a criterion for QoS as perceived by the users. Deb and Ahmed (2018) investigated the quality of bus service based on the perceptions and expectations of the users of the service. A questionnaire survey was conducted to elicit qualitative information on the bus service concerning the users' perceptions and expectations. Subsequently, to ascertain the latent factors that affect the perceptions and expectations of the users, a combination of factor analysis, linear regression, and structural equation modelling (SEM) were carried out. Safety, accessibility, comfort, and timely performance were the notable latent factors outputs, with their respective perceived and expected values. The findings revealed that users' perceptions and expectations are vital for estimating the QoS. According to Carreira *et al.* (2014), some of these factors that influence QoS are interconnected with several different aspects of service provision, which include the value, satisfaction, and users' sentiments towards the service

Mortona *et al.* (2016) examined the ease of use issues which are related to attitudes towards the perceived quality of bus service. Thus, the user attitude to the service matters for determining QoS. They then further explored the socioeconomic characteristics of the users to establish any variations in the views because of the users' socio-economic configurations. The findings revealed a significant variation in attitude across the user groups concerning QoS. In a study to determine perceived service quality and commuter segmentation, Amrapala and Choochakul (2019b) identified attitudinal factors including in vehicle environment, comfort, and convenience. The operators and authorities of public transport need to understand how consumers evaluate the quality of service is. Nevertheless, evaluation of quality by users is an intangible concept to measure, which makes the construction of valid and accurate tools for the measurement of quality of service complicated. Transport attributes such as safety and comfort are abstract and intangible attributes that are difficult to measure (Beirao & Cabral, 2007; Parasuraman *et al.*, 1985).

3.0 Methods

This section presents the study area, MCA of IPT, the survey instrument, sample size, and sampling procedure used in this research.

3.1 Multicriteria Analysis of Informal Public Transport

Multi criteria analysis is a decision-making method that considers interacting variables for different situations to solve problems. In particular, the multicriteria analysis method used in this case study is the Simple Multiple Attribute Rating Technique (SMART) that allows for weight assignment to the interacting variables and accepted for use in transport related studies (Velasquez & Hester, 2013). It is useful for uncovering the nature of problems that arise from multiple interacting variables (Kavran *et al.*, 2007; Moufad & Jawab, 2017). The reality of the informal transport sector is that the various attributes

of informal transport need to be evaluated by a model which can allow the analysis of these various attributes simultaneously. Indeed, the multi-criteria analysis model is suitable for problems that are ‘ill-structured’ (Farahani *et al.*, 2010), where ill-structured problems are practically surrounded by uncertainties and are complex (Kavran *et al.*, 2007; Farahani *et al.*, 2010). Therefore, evaluating and solving these problems requires appropriate multiple criteria to evaluate them. According to Kavran *et al.* (2007), the public urban transportation system efficiency is dependent on identifying the appropriate parameters and their weighted values attached to set criteria.

In this case study, the following criteria were used to evaluate QoS: accessibility at both the origin and destination, cost, travel time, waiting for time, comfort, drivers' attitude, speed, safety, and bus stop facilities for the MCA of IPT in the study area. Such criteria have been applied in previous studies on assessment of service delivery gaps in informal transport (Amrapala & Choocharukul, 2019a and 2019b) and in the study on resilience of informal transport practice in Ibadan (Moyo & Olowosegun, 2021). These criteria were acknowledged by the interviewed users of informal transport in this case study as factors influencing user perception of the suitability of informal transport.

3.2 Survey Instrument, Sample Size, and Sampling Procedure

The study used a mixed-method approach, however, in this paper, the findings from the data collection method based on a questionnaire survey are presented. This paper is based on a questionnaire of users' perceptions of the quality of service (QoS) of informal public transport (IPT) in Ibadan, Nigeria. The data was collected across three local government areas (LGAs) in Ibadan, and questionnaires were administered to individual users of IPT as a major stakeholder in the transport service sector in the city. The questionnaires were deployed during the weekdays and weekends, peak and off-peak hours of the day over three weeks. The selection of the survey period was set to avoid seasonal peak periods such as public holidays that tend to increase transport demand.

A total of four hundred and eighty-eight (488) questionnaires were shared amongst the enumerators and administered after being allocated to different LGAs. This is important to avoid overlap by the enumerators in the areas in which the bus services are run across the LGAs. A stratified simple random sampling strategy was adopted. The three local government areas were considered stratified zones based on the transport corridors of the National Union of Road Transport Workers (NURTW). The precautionary principles were used to ensure the quality of data collected by the enumerators was not compromised. Firstly, it was ensured that the administration of questionnaires was set out zone by zone based on the bus interchanges for close monitoring. Secondly, about 60% of the total questionnaires were administered on-board and about 40% around the IPT facilities.

There were four hundred and sixty-two (462) questionnaires that were validly completed which comes to 94.67% of the total questionnaires sent out, while twenty-six questionnaires were incomplete (5.37%). A total of two hundred and eighty-eight (288) questionnaires were completed on-board while one

hundred and seventy-four (174) were completed off-board, both at origins and destinations. Table 1 shows a summary of the questionnaires administered in the three LGAs of the study.

Table 1: The summary of the questionnaires administered in the three LGAs of study

LGA	Numbers Administered	Completed		Incomplete
Ibadan North	172	166	On-board:123	6
			Off-board:43	
Ibadan North West	155	138	On-board:116	17
			Off-board:22	
Ibadan North East	161	158	On-board:49	3
			Off-board:109	
Total in the 3 LGAs	488	462	On-board:288	26
			Off-board:174	

Subsequently, a multi-criteria approach was adopted to evaluate the QoS of informal public transport in Ibadan. The evaluations were carried out for each of the three LGAs of study and the combined LGAs.

4.0 Findings, Analysis and Discussion

4.1 Socio-economic characteristics and IPT service use by respondents

Table 2a shows a summary of the key statistics of the participants' responses. The male and female respondents accounted for 53.6% and 46.4% of the sample, respectively; of which 96.5% of the overall respondents possessed formal education, while about 3.5% had no formal education. Some 63.9% of respondents were aged 34 years and below; 83.0% of respondents were employed, and 50.7% earned a monthly income ₦ 50,000 and below.

Table 2a: The summary of the key statistics of the respondents

Variables		F (%)	F (%)	F (%)	F (%)
		IN	INW	INE	TTLGAs
Gender	Male	85(51.5)	65(47.1)	97(61.4)	247(53.6)
	Female	80(48.5)	73(52.9)	61(38.6)	214(46.4)
Educational Status	No Formal	9(5.4)	2(1.4)	5 (3.2)	16(3.5)
	Primary	13(7.8)	9(6.5)	7(4.4)	29(6.3)
	Secondary	52(31.3)	35(25.4)	82(51.9)	169(36.6)
	Higher Education	92(55.5)	92(66.7)	64(40.5)	248(53.6)
Age	18-24	46(28.0)	38(28.2)	64(40.8)	148(32.4)
	25-34	62(37.8)	40(29.6)	41(26.1)	144(31.5)
	35-54	40(24.5)	42(31.1)	30(19.1)	112(24.5)
	55-64	13(7.9)	14(10.43)	22(14.0)	49(10.7)
	65 and above	3(1.8)	1(0.7)	0(0)	4(0.9)
Occupational Status	Public sector	23(13.9)	20(14.5)	24(15.3)	67(14.5)
	Private sector	26(15.7)	43(31.2)	44(28.0)	113(24.5)

	Self-employed	91(54.7)	50(36.2)	62(39.5)	203(44.1)
	Unemployed	26(15.7)	25(18.1)	27(17.2)	78(16.9)
Monthly Income	Less than 10,000	21(14.6)	23(20.2)	29(18.35)	73(18.2)
	Between 10,000 and 20,000	40(28.0)	27(23.6)	38(24.1)	105(26.2)
	Between 21,000 and 50,000	41(28.7)	30(26.3)	41(26.0)	99(24.6)
	Between 51,000 and 100,000	14(9.8)	15(13.2)	15(9.4)	44(10.9)
	Over 100,000	4(2.8)	6(5.3)	5(3.2)	15(3.7)
	Not Sure	23(16.1)	13(11.4)	30(18.9)	66(16.4)

IN-Ibadan North, INW-Ibadan North-West, INE-Ibadan North-East, TTLGAs -The Three LGAs

Table 2b gives the frequency of use of the bus service of the respondents. Notably, more than two-thirds (64%) of the total sample use IPT services every day, while less than one-fifth use the IPT services at least 2 days a week (17.4%). The users of service are characterised by a wide range of income and an occupational status indicating the use of informal transport by a range of social groups not limited to lower-income groups.

Table 2b: Frequency of use of the bus service of respondents

Frequency of use	Ibadan North		Ibadan North West		Ibadan North East		TTLGAs	
	F	P	F	P	F	P	F	P
Valid								
Everyday	107	64.5	80	58.5	109	69.0	295	64.0
2 days a week	30	18.1	30	21.9	20	12.6	80	17.3
3 days a week	8	4.8	11	8.0	8	5.1	28	6.1
4 days a week	6	3.6	8	5.8	2	1.3	16	3.5
5 days or more	15	9.0	137	5.8	19	12.0	42	9.1
Total	166	100	137	100	158	100	461	100

F=Frequency, P=Percentage

From Table 2c, the following summarises the key profile from the information. Almost two-thirds (60.3%) of the respondents disclosed that the waiting time at the bus stops/interchange was under 10 minutes, while about one-fifth (19.5%) disclosed that their waiting time was over 15 minutes. It seemed

that the amount respondents were willing to pay was not largely varied by the gender of the IPT users. In this table, we have used gender classification as opposed to one of many other socio-economic characteristics. This is because we want to explore if women's transport choices reflect a 'mobility dilemma', linked to, what Garibi et al 2010 and others (Valentine 1992; Dunckel-Graglia 2013) describe as, a form of gender inequality in public transport. Nearly 31% and 24% of the male and female respondents respectively disclosed that they are comfortable with the speed of the IPT services. While about 9.8% and 7.8% of the male and female respondents respectively disclosed that IPT service speed is unsafe for them. In terms of the availability and comfortability of the seats, about 20.9 % and 14.2% of the male and female respondents respectively disclosed that seats are always available and comfortable. While about 20.5 % of the male and female respondents each disclosed that seats are always available but not comfortable. And about 4.4 % and 4.1% of the male and female respondents respectively disclosed that seats are not always available and not comfortable. Regarding the drivers' attitude, about 33.4 % and 29.5 % of the male and female respondents respectively disclosed that the drivers and the conductors have a fair attitude. While about 6.3 % and 6.7% of the male and female respondents respectively disclosed that the drivers and the conductors have a bad attitude.

Table 2c: IPT service use characteristics by gender for the TTLGAs

Characteristics of the Use of IPT services	Male	Female
Time taken to walk to bus stop from home		
Under 5 Min	67 (14.5%)	48 (10.4%)
Under 10 Min	60 (13.0%)	51 (11.1%)
Under 15 Min	63 (13.7%)	52 (11.3%)
Under 20 Min	27 (5.9%)	21 (4.5%)
Over 20 Min	30 (6.5%)	42 (9.1%)
Time taken to walk to bus stop from Destination		
Under 5 Min	67 (14.6%)	50 (10.8%)
Under 10 Min	67 (14.6%)	54 (11.8%)
Under 15 Min	37 (8.1%)	43 (9.4%)
Under 20 Min	32 (6.9%)	23 (5.0%)
Over 20 Min	43 (9.4%)	43 (9.4%)

Usual travel time for your journey

Under 10 Min	34 (7.4%)	29 (6.3%)
Under 20 Min	57 (12.4%)	56 (12.2%)
Under 30 Min	70 (15.2%)	58 (12.6%)
Under 45 Min	23 (5.0%)	19 (4.1%)
Under 60 Min	62 (13.5%)	52 (11.3%)

Waiting time at the bus stops/interchanges

Under 5 Min	79 (17.3%)	63 (13.8%)
Under 10 Min	71 (15.6%)	62 (13.6%)
Under 15 Min	50 (10.9%)	42 (9.3%)
Under 20 Min	25 (5.5%)	16 (3.5%)
Over 20 Min	20 (4.4%)	28 (6.1%)

			Seats not always available & not comfortable			20 (4.4%)	19 (4.1%)	
			Comments on bus speeds of the informal transport					
			Comfortable speed for me				141 (30.6%)	110 (23.9%)
			Comfortable speed for me and my family				42 (9.1%)	45 (9.8%)
			Unsafe speed for me				45 (9.8%)	36 (7.8%)
			Unsafe speed for me and my family				19 (4.1%)	23 (4.9%)
			Attitudes of drivers/ conductors to users					
			Good				64 (13.9%)	47 (10.2%)
			Fair				154 (33.4%)	136 (29.5%)
			Bad				29 (6.3%)	31 (6.7%)
			Trip time appropriateness					
			Yes				136 (29.9%)	105 (23.2%)
			No				98 (21.6%)	92 (20.4%)
			Other				10 (2.2%)	13 (2.7%)

Characteristics of the Use of IPT services	Male	Female
Amount the users are willing to spend on travel		
Below 0	17 (3.7%)	10 (2.2%)
Btw ₦10 - ₦20	48 (10.4%)	39 (8.5%)
Btw ₦25 – ₦35	79 (17.2%)	65 (14.1%)
Btw ₦40- ₦60	30 (6.5%)	32 (6.9%)
Above ₦60	72 (15.7%)	68 (14.8%)
How comfortable are the seats		
Seats are always available & comfortable	96 (20.9%)	65 (14.2%)
Seats not always available but comfortable	36 (7.8%)	35 (7.6%)
Seats are always available but not comfortable	94 (20.5%)	94 (20.5%)

4.2 Quality of Service Evaluation

A multi-criteria evaluation framework was developed based on criteria identified for assessing the quality of service (QoS) from the literature such as Parasuraman *et al.*, 1988, Carr, 2007, Stradling *et al.*, 2007, Wang *et al.*, 2010, Guillen *et al.* 2013 and Hrelja *et al.*, 2016. Subsequently, the various indicators were identified as relevant in considering the assessment of the QoS for the IPT service in Ibadan. Following this, the study developed an averaging model of the criteria for the QoS evaluation of informal public transport (IPT) in the study area in three local government areas (LGAs) in Ibadan, using the following process:

Step 1: Assigning weights to individual observed variables of the set criteria

Weights were assigned to each of the observed variables of the set criteria, which serve as indicators for the assessment of the QoS. During data collection, the users and other stakeholders which include the National Union of Road Transport Workers (NURTW), Vehicle Inspection Office (VIO), and allied professionals were asked to give weights to the indicators of the sets of criteria, to discover which indicators the stakeholders attached more significance to. The researcher provided a range of values, and the average weight attached to each of the indicators was used in the multi-criteria assessment model that was developed. The weight attached to the indicators of the set of criteria was the outcome of the stakeholders' local knowledge of the impacts of the various factors that influence the QoS of the local

transport. The decision to allow the stakeholders to determine the weights was done with the view to make the planning and implementation of urban planning and development processes more inclusive. Stakeholders were involved in the identification of problems, proffering solutions, and evaluating the plans (solutions) adopted. Table 3 shows the weights attached to the indicators. For instance, the weight attached to accessibility is 10 at the maximum and 2 at the minimum. While, drivers' attitude is 4 at the maximum and 0 at the minimum. Nevertheless, all the values of indicators are standardised in the model.

Table 3: Weights attached to the indicators

S/n	Variable Codes/Indicators	Weights attached to the indicators				
1	access_origin	Under 5min	Under 10Mins	Under 15mins	Under 20mins	Over 20mins
	Weight	10	8	6	4	2
2	access_destin	Under 5min	Under 10Mins	Under 15mins	Under 20mins	Over 20mins
	weight	10	8	6	4	2
3	cost	Below N 20	btw N 20 and N 30	btw N 35 and N 50	Btw N 55 and N 70	Above N 70
	weight	10	8	6	4	2
4	travel_time	Under 5min	Under 10Mins	Under 15mins	Under 20mins	Over 20mins
	weight	10	8	6	4	2
5	waiting_time	Under 5min	Under 10Mins	Under 15mins	Under 20mins	Over 20mins
	weight	10	8	6	4	2
6	seat_comfort	Seats always available & comfortable	Seats not always available but comfortable	Seats always available but not comfortable	Seats not always and not comfortable	
	weight	4	2	2	0	
7	Driver's attitude	Good	Fair	Bad		
	weight	4	2	0		
8	travel speed	Comfortable speed for me	Comfortable speed for me & my family	Unsafe speed for me	Unsafe speed for me and my family	
	weight	2	4	0	0	
9	safety	Safe during but not at night	Safe during the day and night	Unsafe at all times	Unsafe on particular routes	
	weight	2	4	0	0	
10	bus_stops design	Good	Fair	Bad		
	weight	4	2	0		

Step 2: Calculating the sum of the weighted indicators

For the calculation of the sum of the weighted indicators, the frequency of each of the observed variables, i to k , and the weighted individual observed values as tabulated in Tables, were taken into consideration. Where i to k is 1 to 166 for Ibadan North LGA, 1 to 138 for Ibadan North West LGA, 1 to 158 for Ibadan North East LGA, and 1 to 462 for the three LGAs considered for this study. The sum of the weighted indicators is given by the sum of the product of the frequency and weighted individual observed values for i to k , as given in Equation 1. The outputs from this equation are given in Appendices 1a-d.

Step 3: Determining the percentage of variables input towards the QoS and average QoS evaluation

Determination of the Percentage of variables input towards the QoS for each of the set criteria was derived by dividing the product of the sum of weighted indicators (W_v) and 100 by the sum of Total weight ($\Sigma w_T.N$) of all the options for a given variable and sample size, as shown in Equation 2. The outputs for the sum of weighted indicators ($\Sigma w_T.N$), the sample size (N), the total weight of all the options for a given variable for Ibadan North(IN), Ibadan North West (INW), Ibadan North East (INE), and the three LGAs (TTLGAs) are tabulated in Tables 4. While the respective percentage of variables input towards the QoS these LGAs are shown in Figure 2a-d.

The average QoS evaluation (AQoSE) was determined by averaging out the Percentage of variables input towards the QoS using the number of criteria, as shown in Equation 3. This will help to give a single value which define a group of evaluation criteria. Therefore, it is a representative of the entire variables inputs towards the QoS. The AQoSE outputs for the respective LGAs are given in Figures 2a-d.

In this study, the point scale is assumed to a normal distribution, and the median value of the scale is allocated as the acceptable QoS (ATQoS), in terms of percentage, ATQoS stands 50 percent and above.

The outputs of the three steps in Equations 1-3 were computed using Microsoft Excel

W = Sum of weighted indicators

w = Weighted individual observed value

F = Frequency

P_V = Percentage of variables input towards the quality of service (QoS)

w_T = Total weight of all the options for a given variable

O_{ik} = Observed Variables i to k

${}_nC$ = Number of Criteria

N =Sample Size

AQoSE = Average Quality of Service Evaluation

$$W = \Sigma(F_{oi}^{wi} + F_{oj}^{wj} + \dots \dots \dots F_{ok}^{wk}) \dots \dots \dots \text{Equation 1}$$

$$P_V = \frac{W_v}{\Sigma w_T.N} \times 100 \dots \dots \dots \text{Equation 2}$$

$$AQoSE = (P_{Vi} + P_{Vj} + \dots \dots \dots P_{Vk})/{}_nC \dots \dots \dots \text{Equation 3}$$

4.2.1 Multi-Criteria Evaluation of Quality of Service

The multi-criteria evaluation starts with the computation of the weighted indicators. Appendices 1a to 4d show the weighted indicators for Ibadan North, Ibadan North West, Ibadan North East and the combined three LGAs, respectively.

The sum of weighted indicators for each of the LGAs and the combined LGAs were prepared using Equation 1. Subsequently, the product of the sum of the total weight was computed. Table 4 shows the computed sum of weighted indicators and the sum of the total weight.

Table 4: Sum of Weighted Indicators and Product of the Sum of Total weight of all the options and the Sample Size in Ibadan North LGA

W=Sum of weighted Indicators				N=Sample Size				Sum(w)				Sum(w)*N			
IN	INW	INE	TTLGAs	IN	INW	INE	TTLGAs	IN	INW	INE	TTLGAs	IN	INW	INE	TTLGAs
1180	906	980	3054	166	138	158	462	30	30	30	30	4980	4140	4740	13860
1048	926	1044	3018	166	137	157	460	30	30	30	30	4980	4110	4710	13800
756	690	920	2366	165	138	158	461	30	30	30	30	4950	4140	4740	13830
924	802	980	2706	166	138	157	461	30	30	30	30	4980	4140	4710	13830
1160	1030	1116	3306	163	137	157	457	30	30	30	30	4890	4110	4710	13710
436	424	460	1164	164	138	158	460	8	8	8	8	1312	1104	1264	3680
328	326	370	1024	166	138	158	462	6	6	6	6	996	828	948	2772
350	316	356	850	166	138	158	462	6	6	6	6	996	828	948	2772
420	392	430	1168	166	138	158	462	8	8	8	8	1328	1104	1264	3696
264	340	346	950	165	138	158	461	6	6	6	6	990	828	948	2766

The next step was to calculate the percentage evaluation (PE) of the quality of service (QoS) in the study area. The percentage of variables inputted for the QoS are given in Figures 2a to 2d and were calculated using Equation 2, while the Average Quality of Service Evaluation was calculated using Equation 3.

The bar graphs (Figures 2a to 2d) were produced to show the contributions and variations of each criterion in the QoS evaluation. The horizontal line AQoSE passing through the bars indicates the criteria that fall below the overall average of the assessment. While, the horizontal line ATQoS denotes the assumed acceptable Quality of Service.

In Ibadan North, from the results shown in Figure 2a, the accessibility at the origin and destination, cost, the travel time and waiting time, were below the perceived percentage average quality of service.

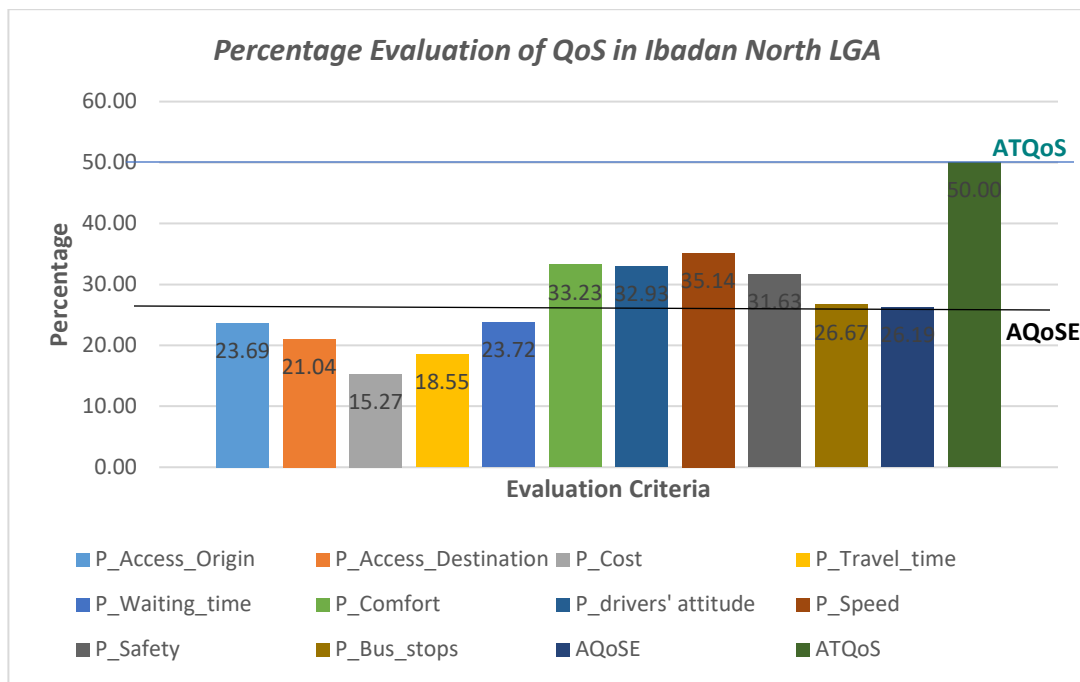


Figure 2a: Percentage Evaluation of QoS in Ibadan North LGA

In Ibadan North West, from the results shown in Figure 2b, the accessibility at the origin and destination, cost, the travel time, and waiting time were below the percentage average quality of service.

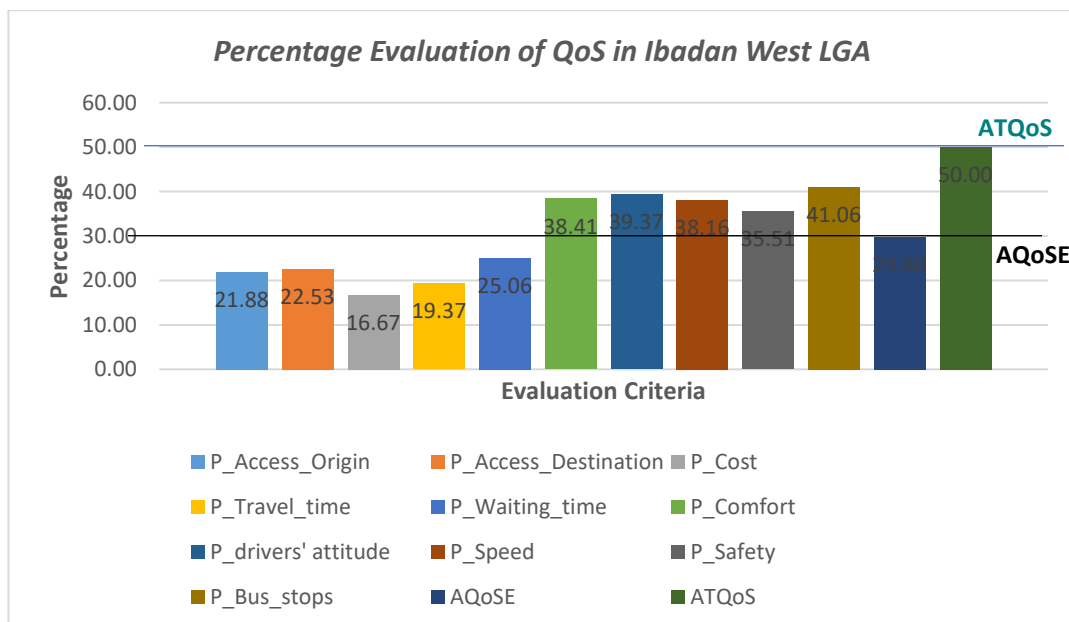


Figure 2b: Percentage Evaluation of QoS in Ibadan North West LGA

In Ibadan North East, from the results shown in Figure 2c, the accessibility at the origin and destination, cost, the travel time, and waiting time were below the percentage average quality of service.

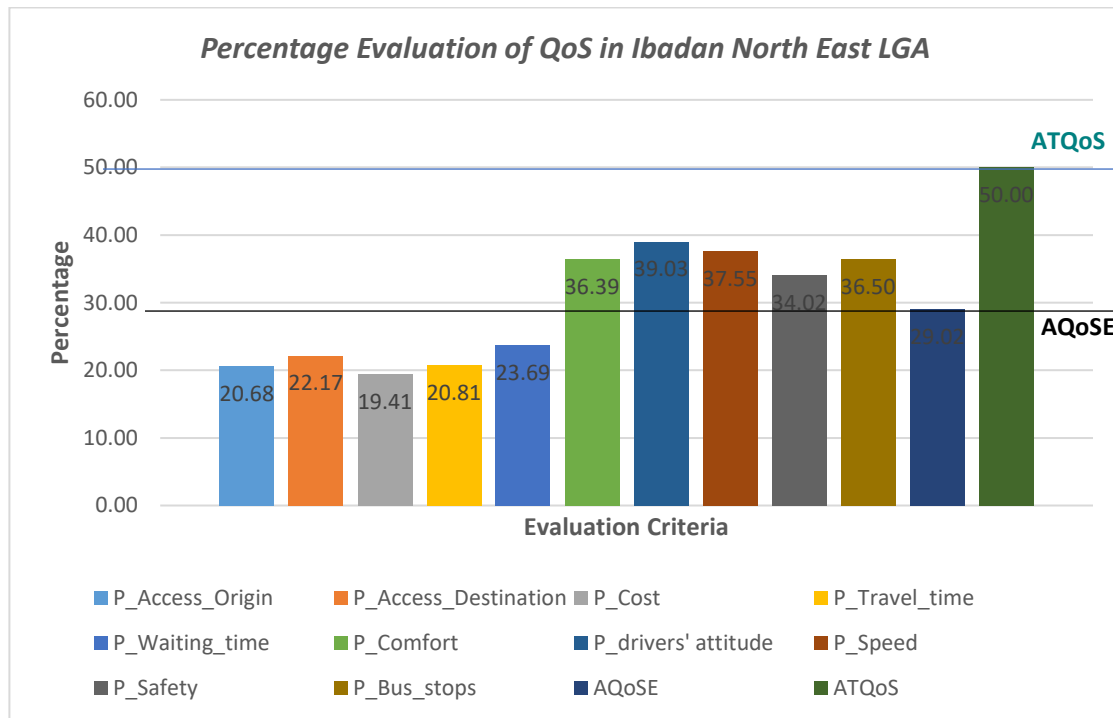


Figure 2c: Percentage Evaluation of QoS in Ibadan North East LGA

The overall results of the combined three LGAs reflect the same pattern as the three individual LGAs. Figure 2d shows that the accessibility at the origin and destination, cost, the travel time, and waiting time are all below the percentage average quality of service.

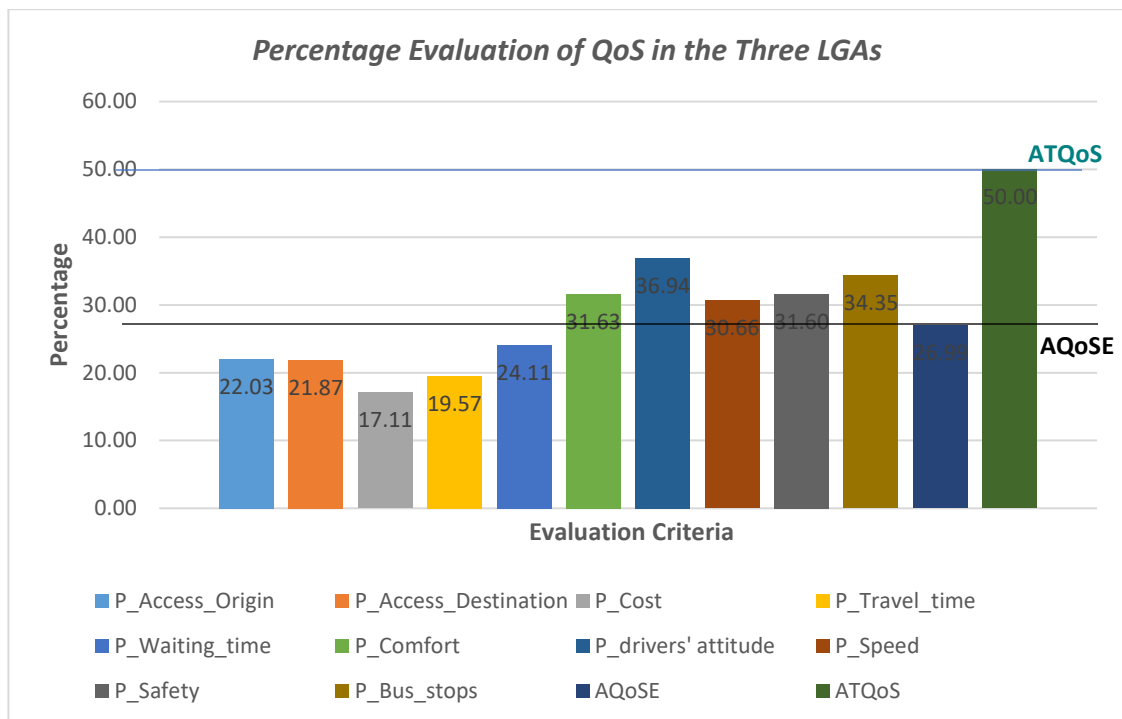


Figure 2d: Percentage Evaluation of QoS in the three LGAs (TTLGAs) of the study

The comparison of the evaluation across the LGAs of study is given in Figure 2e. It shows some level of homogeneity in the outcomes and the average QoS Evaluation (AQoSE) are higher than the percentage evaluation of accessibility, transport fare (cost), travel and waiting time. However, AQoSE are lower than the percentage evaluation of comfort, driver's attitude, speed, safety, and bus stops.

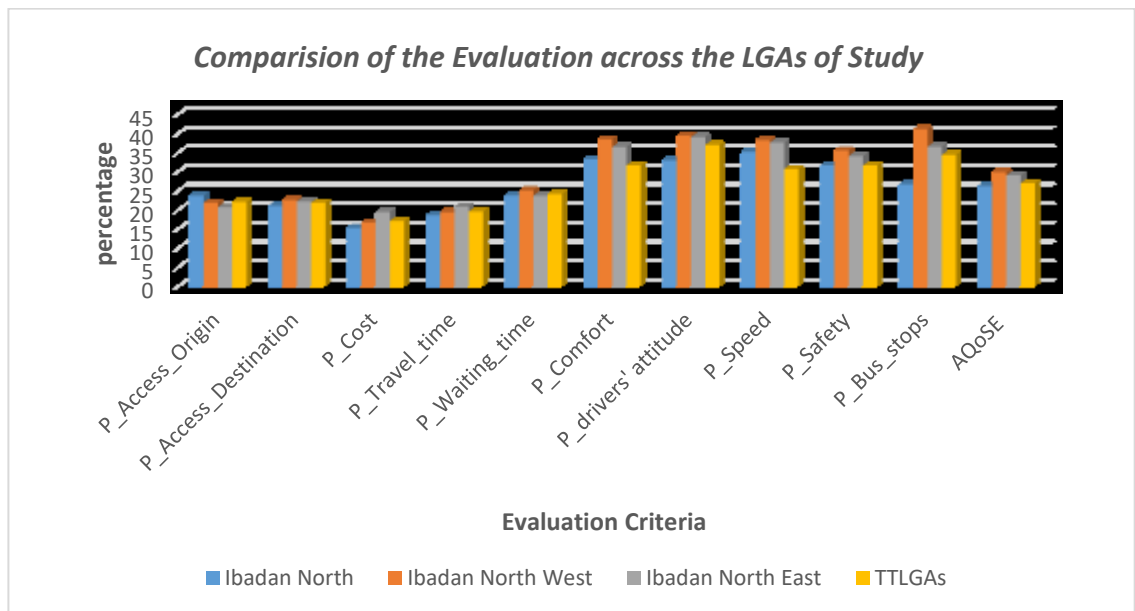


Figure 2e: Comparison of the evaluation across the LGAs of study

4.2.2 Discussion of the Findings

The criteria used which include accessibility, affordability in terms of transport cost, travel time, waiting time, comfort, drivers' attitude, speed, and bus-stops availability, revealed a low QoS. For instance, the findings from the model on the overall contribution of accessibility to the QoS revealed that the accessibility from both the origin and destination was below 25 percent. It was below the average Quality of Service evaluation (AQoSE) in all three LGAs in this study. Also, the AQoSE in all the LGAs of study are lower than the assumed acceptable quality of service (ATQoS) which is placed at 50 percent.

Accessibility

The model showed that the accessibility of IPT at the origin and destination are about 24% and 21% respectively in IN LGA; about 22% and 23% respectively in INW LGA, and about 21% and 22% respectively in INE LGA. While it was about 22% for both the origin and destination for TTLGAs. The percentage evaluation of the accessibility at both the origin and destination in each LGA were below the AQoSE, where the overall average stands at 26.99% for all the three LGAs considered in this study (See Figures 2a-d). The findings on accessibility are not in absolute agreement with the narratives from earlier studies of IPT in developing countries, such as in Indonesia and Kenya (Cervero, 2000; Cervero & Golub, 2007) which posit that IPT fills gaps in service provision to larger areas of the city – the services still seem inadequate. However, it remains a key service provider to the general public and some specific niche markets, such as students and traders (Pucher & Korattyswaroopam, 2004; Cervero & Golub, 2007; Ettema *et al.*, 2016).

Transport fares

The model showed that the transport fares' affordability is below 20% and below the AQoSE in all the three LGAs considered in this study. Against the backdrop that it was considered as a mode of transport for the poor in earlier studies (Cervero & Golub, 2007; Pucher *et al.*, 2005; Pucher & Korattyswaroopam, 2004), in Ibadan the stakeholders' view was that IPT bus services are not only for the poor – it is the primary mode of public transport service available. The possible explanation for this may be that the services are not giving users value for their money. In other words, the QoS is low concerning the fares being charged.

Travel time

The model showed that travel time was rated at about 19% in IN LGA; about 19% and 21% in INW and INE LGAs respectively; while it is about 20% for TTLGAs (See Figures 2a-d). The percentage evaluation of the travel time in each LGA is below the AQoSE, where the overall average stands at 26.99% for all the three LGAs considered in this study. This suggests services undertaking slow round trips, possibly caused by intermittent picking up and dropping off passengers, which implies that percentage evaluation of travel time as a factor contributes to lower the overall QoS. This indicates a significant impact on the user's wellbeing in terms of time as a resource, as the state of the IPT services makes it difficult for users to engage in any other activities,

such as working on their laptop while journeying. The results contradict studies on activity-based travel demand, where users can use part of the travel time for activities such as reading (Ettema *et al.*, 2010; Martin *et al.*, 2014).

Waiting time

The model showed that the waiting time for IPT is about 24% in IN LGA; about 25% and 24% in INW and INE LGAs respectively; while it is about 24% for TTLGAs (See Figures 2a-d). The percentage evaluation of the safety in each LGA is above the AQoSE, where the overall average stands at 26.99% for all the three LGAs considered in this study. This is an indication of long waiting times in some instances caused by high traffic at peak hours or waiting for users at either origin/destination as there is no formal scheduled trip time. There is a tendency when no such scheduled trip time exists for operators to take advantage to ensure that all the seats are occupied either at the origin or destination, to ensure maximum profits on a round trip – resulting in longer waiting times. The results are consistent with previous studies (Gwilliam, 2003; Pucher *et al.*, 2005).

User comfort

The model showed that user comfort in terms of seat comfort and seat availability stands at a rating of about 32% for TTLGAs, which is greater than the AQoSE in all the three LGAs considered in this study (See Figures 2a-d). The outcome concurred with explanations from earlier studies (Cervero & Golub, 2007; Skinner & Masuda, 2013), that user comfort is compromised during service provision, and their wellbeing is negatively impacted. Therefore, this is an indicator that such a low-level comfort experienced by users requires an interventionist policy in the governance of public transport through IPT services. Failure to intervene may discourage the use of public transport in Ibadan and might boost the desire for private car use – which would contribute to traffic congestion and all forms of pollution. Therefore, policy intervention that seeks to improve the users' comfort and provide good customer service by the operators (the drivers and conductors in particular) must be implemented.

Drivers' attitude

The model showed that the drivers' attitude in terms of friendliness is about 40% for TTLGAs and above the AQoSE for all the three LGAs considered in this study (See Figures 2a-d). This outcome is in line with earlier studies (Trans-Africa-Consortium, 2010; Gwilliam 2003) that there is a high frequency of aggressiveness and recklessness in IPT driving styles. Substance intake, which includes alcohol and cannabis, was also found to influence driver mannerisms and attitudes towards passengers and other road users. Certainly, these acts contribute negatively to QoS and the users' and city's wellbeing. Good customer service should be offered in tandem with the actual need of the IPT users (Cervero, 2000; Wolff *et al.*, 2013).

Safety of service

The model showed that the safety of IPT is about 32% in IN LGA; about 36% and 34% in INW and INE LGAs, respectively; while about 32% for TTLGAs. The percentage evaluation of the

safety in each LGA is above the AQoSE, where the overall average stands at 26.99% for all the three LGAs considered in this study (See Figures 2a-d). These results reflect the outcomes of the earlier studies (Trans-Africa-Consortium, 2010; Gwilliam, 2003), which show there is a prevalence of overloading related issues with IPT, the use of vehicles that are not roadworthy, and violating road traffic rules and signals – which make the IPT services often feel unsafe for users. Furthermore, it is in agreement with the explanations provided by Gwilliam (2003), who found that attacks by hoodlums, harassment by drivers and conductors, incidents of rape by operators, and violence resulting from conflicts among operators and users are associated with IPT services and are common incidences.

Speed

The model showed that the speed in terms of reliability is about 35% in IN LGA; about 38% and 34% in INW and INE LGAs, respectively; while it is about 30% for TTLGAs (See Figures 2a-d). The percentage evaluation of the speed in each LGA is above the AQoSE, where the overall average stands at 26.99% for all the three LGAs considered in the study. The reliability and safety challenges may be connected to the prevalence of overloading-related issues, the use of buses that cannot pass the test of roadworthiness, and partial/outright violation of road traffic rules and regulations. Also, this calls for policy intervention and enforcement. Further insight from the studies suggests that the use of deficient vehicles negatively affects the overall QoS, the users' wellbeing, and the urban environment. These outcomes are consistent with the earlier studies (Kutzbach, 2009; Vasconcellos, 2001), that show that IPT services in developing countries are slower in covering comparable trip distance compared to other modes of transport.

Bus stop facilities

The model showed that bus stop facilities were evaluated at about 27% in IN LGA; about 41% and 37% in INW and INE LGAs, respectively; while at about 34% for TTLGAs. The percentage evaluation of the bus stop facilities in each LGA is above the AQoSE in all the three LGAs considered in the study (See Figures 2a-d). The overall average of AQoSE stands at 26.99% for TTLGAs, which is considered low. This is in agreement with earlier studies on the state of public transport facilities in developing countries (Kutzbach, 2009; Cervero & Golub, 2007; Ingram & Liu, 1997), which show that they are inadequate resulting in saturation, besides the poor condition of the bus stop facilities in Ibadan, the users' view was that there is a lack of shelters, with locational deficiencies being potent factors that diminish the QoS of IPT.

The model shows that the prevalence of bus stops and bus interchanges facilities is low, although it is greater than the AQoSE in all the three LGAs considered in the study. This may be largely connected to the poor planning of these facilities and non-adherence to standards in the location of these facilities.

5.0 Conclusion

Implications of the evaluation to policy for public transport in developing countries

The model revealed evidence of low QoS of IPT. Considering the well-being of the users and the urban environment, there is a need to introduce measures that enhance the various aspects of the criteria used for this MCA. This will enhance the quality of this important public service, which has survived even while the formal public transport services in most cities of developing countries have collapsed or remain comatose.

While IPT services are resilient, the model outputs highlight that interventionist policy must be introduced that are properly tailored to address the overall QoS of IPT. However, care must be given so as not to annul some of the positive effects of IPT, such as the important employment it provides (drivers, conductors, union members).

The model employed here is simple and can be used for the periodic evaluation of QoS by feeding data into the prepared Excel spreadsheet to compute outputs. This provides a simple and effective tool for the task of QoS evaluation, supplying an evidence base to inform policy direction in terms of enhancing the QoS of IPT and the consequent impacts on the wellbeing of the users and urban environment.

Concluding remarks

This paper fills a research gap by supplying an evaluation of the quality of service of IPT in a developing country context in Ibadan, Nigeria, using a multi-criteria evaluation model approach. It employs a clear and concise approach with a preselected criteria, which includes accessibility, affordability, travel time, waiting time, comfort, drivers' attitude, speed, safety, and the condition of bus stops for the assessment of the QoS of IPT (Danfo Buses) in Ibadan. The selected criteria were developed across the three identified QoS typologies of service infrastructure characteristics, features of mode of travel, and user needs.

The multi-criteria evaluation model helped to integrate different perceptions drawn from the criteria for assessing the QoS of public transport. This was done by averaging the outcomes of the perceptions after weights were attached to the variables. This process helped to assess the QoS on a scale from 0 to 100 percent. For instance, the users rated the QoS of accessibility, affordability, travel time, and waiting time in the three LGAs individually below 25%. They similarly rated comfort, drivers' attitude, speed, safety, and bus stops range between 30-37%. In terms of the users' general assessment of IPT's QoS, the overall average quality of service (AQoSE) was approximately 27%. Thus, the multi-criteria evaluation showed the poor QoS of IPT in Ibadan.

However, when perceptions are subjected to the weight of the variables attached to the criteria in assessing the average quality of service (AQoS), the outcomes also revealed a low AQoS. In conclusion, there is a need for a policy platform that addresses the low QoS and operational performance of the typical informal public transport service in developing cities, as this would make up a major contribution to the socio-economic wellbeing of urban dwellers.

The case study findings from the multicriteria evaluation model has potential for transferability in the evaluation of the quality of service of IPT using a range of criteria that are context specific and can be applied to influence policies seeking to enhance the Quality of Service of IPTs in different country contexts. Given the growth trend in the use of informal transport such a model advances policy consideration toward supporting the resilience of IPT in cities of the developing countries.

6.0 Recommendations

The outcomes of the public perceptions of the role of informal public transport show the need for its recognition beyond it being physical infrastructure but to recognise its wellbeing attributes to serving the urban communities in cities of the developing world and there effort is necessary to improve its quality of service.

Based on the outcomes of this study, to enhance the QoS of public transport in Ibadan, it is recommended that considerations must be given for intervention beyond to include a multi-criteria analysis of public wellbeing such as accessibility, security, and safety. There is a need for prompt intervention by the planners and policymakers that the overall low QoS is addressed in the overall interest of urban wellbeing. Furthermore, it is recommended for stronger governance institutions that would handle such recognition through relevant policies and practices.

Acknowledgement: We appreciate Prof Stephen Hubbard for checking through the evaluation model. We also thank the anonymous reviewers for all their feedback and comments which has greatly helped in strengthening the arguments.

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Appendices

Appendix 1a: Weighted indicators in Ibadan North LGA

CRITERIA	FO1	FO2	FO3	FO4	FO5	FO1*w1	FO2*w2	FO3*w3	FO4*w4	FO5*w5
Access_Origin	55	44	31	10	26	550	352	186	40	52
Access_Destination	41	40	28	18	39	410	320	168	72	78
Cost	5	18	58	23	61	50	144	348	92	122
Travel_time	19	37	44	21	45	190	296	264	84	90
Waiting_time	47	51	33	10	22	470	408	198	40	44
Comfort	46	20	90	8		184	40	180	32	0
drivers' attitude	27	110	29			108	220	0		
Speed	95	23	31	17		190	92	0	68	
Safety	64	59	29	14		128	236	0	56	
Bus_stops	25	82	58			100	164	0		

Appendix 1b: Weighted indicators in Ibadan North West LGA

CRITERIA	FO1	FO2	FO3	FO4	FO5	FO1*w1	FO2*w2	FO3*w3	FO4*w4	FO5*w5
Access_Origin	33	38	22	25	20	330	304	132	100	40
Access_Destination	36	42	17	22	20	360	336	102	88	40
Cost	9	23	40	22	44	90	184	240	88	88
Travel_time	25	25	37	14	37	250	200	222	56	74
Waiting_time	53	33	27	13	11	530	264	162	52	22
Comfort	56	22	42	18		224	44	84	72	0
drivers' attitude	36	91	11			144	182	0		
Speed	80	30	19	9		160	120	0	36	
Safety	58	59	11	10		116	236	0	40	
Bus_stops	50	70	18			200	140	0		

Appendix 1c: Weighted indicators in Ibadan North East LGA

CRITERIA	FO1	FO2	FO3	FO4	FO5	FO1*w1	FO2*w2	FO3*w3	FO4*w4	FO5*w5
Access_Origin	26	29	64	13	26	260	232	384	52	52
Access_Destination	40	40	35	15	27	400	320	210	60	54
Cost	13	47	46	17	35	130	376	276	68	70
Travel_time	19	52	47	7	32	190	416	282	28	64
Waiting_time	43	49	32	18	15	430	392	192	72	30
Comfort	59	29	57	13		236	58	114	52	
drivers' attitude	48	89	21			192	178	0		
Speed	76	34	31	17		152	136	0	68	
Safety	61	64	20	13		122	256	0	52	
Bus_stops	48	77	33			192	154	0		

Appendix 1d: Weighted indicators in the Three LGAs

CRITERIA	FO1	FO2	FO3	FO4	FO5	FO1*w1	FO2*w2	FO3*w3	FO4*w4	FO5*w5
Access_Origin	114	111	115	48	72	1140	888	690	192	144
Access_Destination	117	122	80	55	86	1170	976	480	220	172
Cost	27	88	144	62	140	270	704	864	248	280
Travel_time	63	114	128	42	114	630	912	768	168	228
Waiting_time	143	133	92	41	48	1430	1064	552	164	96
Comfort	161	71	189	39		644	142	378	0	
drivers' attitude	111	290	61			444	580	0		
Speed	251	87	81	43		502	348	0	0	
Safety	183	182	60	37		366	728	0	74	
Bus_stops	123	229	109			492	458	0		