Decongesting Urban Areas through Implementation of Soft Transportation Policies Encouraging Public Transport Usage: Explaining Critical Success Factors from Commuters' Experience

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ABSTRACT

Urban congestion has been a big impediment to socio-economic development which has led to endless search for ways to curb it. In Dar es Salaam, the government opted for the Bus Rapid Transit (BRT) to encourage public transport usage. The belief is that, with the presence of BRT, private vehicle users will change their travel behaviour towards public transport usage. However, the shift towards using public transport is considered unstable because transport planners believe soft transportation policy won't produce long term effects. This sceptical belief led to the expansion of roads that motivate private vehicle usage due to the reduction of driving costs. The interplay of scepticism of transport planners and an inclination to switching to private vehicle usage affects the long term impact of implementing a BRT system. This study adopted for a descriptive design to explain the factors that influence public transport usage. Data were collected by means of a questionnaire along the BRT phase one network and were subjected to descriptive analysis and principal component analysis. Results depicted lower levels of using BRT buses as a primary commuting option. Results further indicated that, about using BRT buses, commuters stated that travel time reduction and reliability, service accessibility and assurance and trip safety and tangibles were key service quality factors. Thus, BRT faces a low adoption rate; hence private vehicle usage has increased along BRT corridors. To increase and ensure the sustainability of BRT, it is imperative that the quality of service be improved and road expansion to city centre be abated.

Key words

Transportation, Soft Transportation Policies, Congestion, Public Transport

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1.0 Introduction

Today, ensuring that urban areas are sustainable is an important subject. When thinking about sustainable cities it is improbable to drop the subject of traffic congestion (Karimi et al, 2021). Congestion affects the quality of life to urban dwellers through exhausting delays, poor air quality and effects on the economy (Staley, 2012). Increased congestion deteriorates the socio-economic climate of urban dwellers. According to Kumar and Singh (2017), traffic congestion in urban areas is a function of urbanization and ever-increasing private vehicle ownership.

According to United Nations (2014), 54% of world's populations reside in urban areas and, by 2050; the percentage of world's population residing in urban areas will increase to 66%. The projected percentage of residents living in urban areas will add misery to traffic congestion because there is a direct relationship between traffic congestion and population growth. This notion is compounded by Bull (2003) who contends that traffic congestion will be a problem to world's nations, bringing needless menace to quality of life. According to Clarke (2012) and Dong (2016), the key to traffic congestion is population growth in urban areas and, since many households are capable of owning two or more cars, then increased private car travel has brought about social, economic and environmental externalities, the notable one being congestion. Continued private travel is unsustainable; hence behavioural change is pivotal to reducing private car travel. Zhang (2011) contends that city design also influences traffic congestion in cities because most cities were designed during pre-automotive eras; hence they lack streets and roads capable of handling trucks, buses and private vehicles. Also, Wang et al. (2013) argue that most cities in the world are concentric in nature because of the tendency to concentrate building and major social services in one area, thus causing inward and outward transportation chaos.

Dar es Salaam is a city in Tanzania that is no stranger to traffic congestion problems. The city experiences the same causes to traffic congestion which are rapid urbanization, city' concentric nature and an increase in vehicular ownership. Also, traffic problems in Dar es Salaam can be attributed to the poor transportation policy of the country that for long advocated private car ownership, through encouraging continuous improvement of urban infrastructure to accommodate the ever-growing traffic (Msigwa, 2013).

Traffic congestion has direct and indirect costs which force various public authorities to find subtle interventions to tackle it (Albalete and Fagenda, 2019). The interventions to tackle congestion are divided into soft transportation and hard transportation policies (Garling et al, 2016). Hard transportation policies focus on increasing existing infrastructure to increase its traffic handling capacity. However, hard transportation policies that improve infrastructural capacity have proven to be counter-productive because with new road construction in urban areas traffic congestion worsens. Traffic congestion worsens in urban areas because the notion is that traffic fills whatever road space made available (Kumarage, 2004; Bull, 2003; Garling et al, 2016). Handy (2015) argues that adding roads reduces travel time which in turn lowers the cost of driving which leads to increasing the quantity of driving which further complicates congestion issues. On the other hand, soft transportation policies focus on imposing actions that influence the intensity, timing and spatial distribution of transportation demand for the purpose of reducing the impact of traffic flow. Basically, soft transportation policies are focused on advocating the use of public transport and limiting private car usage (Kumarage, 2004; Dong, 2016).

Recognizing the importance of public transport, the government decided to invest massively to improve the public transport system. The decision to change the transportation system led to the introduction of the Bus Rapid Transportation (BRT) system. The introduction of the BRT system was expected to salvage the old transportation system that was regarded as lacking professionalism, unsafe, dilapidated and chaotic (PMO-RALG, 2006). The introduction of the BRT system was expected to improve mobility within the city which in turn would improve living standard of city’s inhabitants, poverty reduction and promote economic growth (DART, 2015). The decision to implement the BRT system is a soft transportation policy because the government wanted to prioritize public transport and non-motorized transport (Tekule, 2012). Although the government has been improving public transport through the BRT system, Garling et al. (2016) argue that transportation planners are sceptical about soft transportation policies to discourage private car usage.

The sceptical belief is vindicated in Dar es Salaam where, despite efforts to lay down infrastructure for BRTs, there are also efforts to expand road infrastructure for private vehicle use. The improvement of road infrastructure encourages private car usage by increasing the number of lanes and promoting the construction of overpasses and underpasses (Kiunsi, 2013). In addition to that, frequent car users are less concerned about the problems associated with car use and perceive policies aimed at reducing car use as illegitimate (Steg, 2003). The propensity to improve road infrastructure leading towards city’s central business district (CBD) along the same corridors where BRT is implemented and the behaviour of car users jeopardizes the long term success of BRT. Therefore, to measure the long term success of soft transportation policies that encourage using public transport in Dar es Salaam, the study assessed the factors that are important to influence public transport usage.

2.0 Literature Review

2.1 Effects of Traffic Congestion

Traffic congestion refers to travel delays caused by vehicle interaction on roadways as traffic volumes approach or exceed roadway capacity (Litman, 2022). Traffic congestion is characterized by slow speeds, longer travel times and increased vehicular queuing. Traffic congestion normally has two causative factors which are too much traffic for the available physical infrastructure to handle and occurrence of traffic influencing events like accidents, breakdowns, bad weather, poorly timed traffic signals and bad weather (Rwakarehe, 2011; Mfinanga and Fungo, 2013). Also, Soliman et al. (2016) argue that traffic congestion can be caused by lack of proper driving behaviour which is characterized by illegal parking, lack of respect to overtaking manoeuvre and disrespecting the general rules of road usage. Traffic congestion has substantial socio-economic effects. The economic impacts of congestion can be explained on the basis of the time wasted and extra fuel consumption. Annually, TZS 655 billion is an economic waste arising from time wasted on roads and extra fuel consumption costs. Also, business profits decrease by 20% as a result of congestion. Further, due to longer time spent on roads, human development is affected because people are deprived of time to spend with family, friends and peers (Msigwa, 2013). Ng'hily (2013) contends that Dar es Salaam region loses TZS 411 billion annually as a result of the region's transportation deficiencies. Mpogole and Msangi (2016) argue that traffic congestion has an implication on workers' productivity. They found that workers spent 2.5 hours on road per day and worked 1.4 times less than expected time due to traffic congestion which further meant that in 10 working days, workers spent 3 days trapped in traffic congestion.

2.2 Soft Transportation Strategies

Soft transportation strategies are interventions aimed at influencing car users to change their mobility behaviours by curbing private car use through information and persuasion (Garling et al., 2016). Soft transportation measures are categorized into soft-pull and soft-push measures. Soft-push measures include fuel pricing, driving restrictions, pollution charges, closing roads, building cycling lanes and parking. On the other hand, soft-pull measures include travel awareness campaigns and free public transport tickets. Both soft-push and soft-pull measures are focused on discouraging private car use and increasing public transport ridership (Semenscu, 2020; Zarabi and Waygood, 2021). Soft transportation measures have been implemented in various cities and have been successful to varying degrees. In Australia, soft transportation measures are referred to as voluntary travel behaviour change (VTBC) where car driving trips were reduced by 14%, car driving kilometres were reduced by 11%, and 30% to 40% of households were at least involved in VTBC program (Garling et al., 2016). In UK and Germany, it was found that soft transportation interventions reduced car modal split share by 5% (Semenescu, 2020). Cisse and Pambuka (2020) argue that Africa has struggled with inefficient public transportation systems, and countries are increasingly switching to BRTs as a soft transportation intervention that is cheaper in comparison to those implemented by their European counterparts. The soft transportation intervention geared towards encouraging public transport in the form of BRT in Tanzania is likely to face a multitude of challenges that can hinder their chances of being successful, and the notable challenges include mismatch with local requirements and skills and training.

2.3 Dar es Salaam Public Transport Profile

Dar es Salaam is one of the fastest-growing cities in the world with an annual growth rate of 7.7% from 2002 to 2012, and it is further expected that the city's population will grow to reach 10 million by 2030 (Kalugendo, 2020). The city is characterized by a concentration of industrial establishments across the entirety of Tanzania; a half of the major manufacturing plants are situated in Dar es Salaam (Mganda, 2017). Considering the dense population in the city and the major concentration of industrial activities, effective transportation is important. According to PMO-RALG (2006), across the city, the majority of trips are made by using public transport means that account for 43% of all trips made while private transport, non-motorized and other means of transport account for 6%, 45% and 6% respectively. Msigwa (2013) argues that 61% of city's commuters rely on public transport. Rwekarehe (2011) argues that, despite low income problems in African countries, people are inclined towards owning private cars out of necessity due to the absence of adequate and attractive public transport. Initially, city inhabitants grudgingly cope with the inefficient public transport, but as soon as they can afford they upgrade to private cars (Iles, 2005).

The city's urban public transport demands were met by a fleet of 9,000 privately owned public buses famously known as daladala. This system of providing public transport services was regarded as old, lacking professionalism, unsafe, chaotic, and services were offered using a fleet of dilapidated buses (Tekule, 2012; DART, 2014; Kalugendo, 2020). Singh (2012) argues that economic efficiencies and wellbeing of urban inhabitants is greatly dependent upon the efficacy with which people and materials are moving across the city. Wright (2004) contends that social and economic amenities are beyond walking and cycling distance. Considering the deficiencies of daladala in offering public transport services, a deliberate decision to improve public transport was made so as to tap on the potential economic contribution by having an effective public transport system. Towards improvement of urban public transport system, various options to improve urban public transport were considered, but BRT was preferred because it was cheap to operate (Mzee, 2017; Kalugendo, 2020).

The implementation of the BRT system in the city commenced in 2012 for the purpose of reducing traffic delays, congestion and road accidents (Bagoka, 2015; Chengula and Kombe, 2017). The large scale investment in the BRT system involves six phases covering a total of 130.3 kilometres. The first BRT phase covers 20.9 kilometres of a trunk route from Kimara Mwisho to the city centre and feeder routes covering 57.9 kilometres, which are operational since 2016. The second phase covering 19.3 kilometres from Mbagala to the city centre is under construction. The implementation of BRT was under public private partnership arrangement (Mzee, 2017; Kruger et al, 2021; Connect Impact, 2019; DART, 2014). The benefits of BRT systems have been well documented. Wright (2004) argues that successful BRT system can lead to reduced travel times, reliable services, equitable access throughout the city, reduced accidents and reduced emissions. Also, Chengula and Kombe (2017) contends that BRT system can lead to travel cost saving, travel time saving, reliability, accessibility, diminished accident rates, commuter comfort and overall socio-economic uplift.

2.4 Challenges with Old Public Transport Services

The old public transport services that were predominantly provided by privately owned buses, famously known as daladala, was shrouded with a number of challenges that made inhabitants to grudgingly use the service. The daladala used to operate for 16 hours a day, hence had little room for cleaning and sustaining the buses, thus leaving the situation inside the buses extremely disastrous. City inhabitants used to condemn the nonchalant nature of bus operators who were very dirty because they neither washed their clothes nor regularly took a bath. Also, it is understood that daladala operations are marred by presence of pickpockets who steal from commuters especially during peak hours. Also, commuters particularly women and children were abused and insulted (Linden et al., 2006). Daladala operators used to deny children or students access to the buses because they are entitled to bus fare reduction that was deemed insufficient to cover operating costs and did not receive any compensation from the government (Weingaertener et al., 2008). Non-collision injuries are pertinent amongst daladala users due to scrambling to board buses and disembarking from the buses. The scrambling for buses that brings about injuries is caused by greater demand for transport services in comparison to shorter supply of available services (Lwanga et al., 2022). Public daladala services are reportedly to be involved in high accident cases in the city, and this is due to driving under influence of alcohol and drugs as well as on-road competition when chasing passengers (Msese, 2015).

2.5 Designing Public Transport For Success

Since public transport is in direct competition with private cars, it is crucial that public transport services be designed in a way that they meet the needs to provide minimum transport services to all people irrespective of car availability, place of residence or physical disability. Also, a robust public transport must be capable of adapting dynamically to ever changing demands of commuters and economic circumstance. This implies that the network of public transport must be robust enough to allow for short term adjustments to trip frequencies, capacity, connecting and disconnecting areas. Additionally, the system must be capable of extending to new areas of urban development without necessarily having to redesign the existing infrastructure (Nielsen and Lange, 2010).

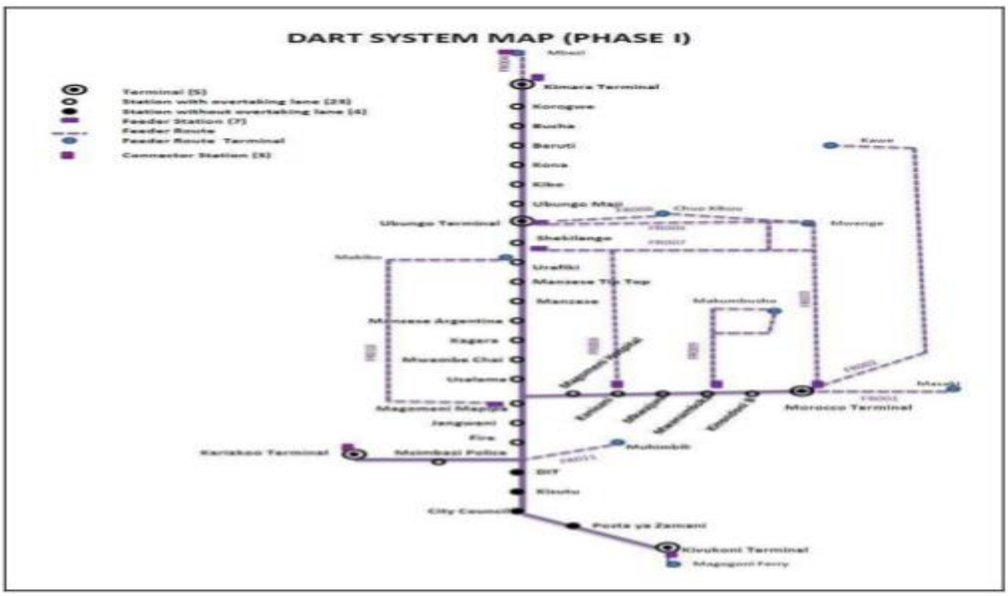
When designing a public transport system it is imperative that transport planners be aware that car usage is evaluated positively in comparison to public transport in every respect. Private cars are more attractive than public transport because private cars offer more convenience, independence, flexibility, comfort, speed, reliability, and also private cars offer more status than public transport (Steg, 2003; Anwar, 2009; Joseph et al., 2020). Public transport usage and private transport usage is a paradoxical situation as both have appealing advantages and mischiefs. The advantages associated with public transport include cost, less stress, no need to drive, being able to relax, less pollution, shorter travel time on bus lanes and being able to rest and read. Also, there are disadvantages to public transport which include waste of time, crowdedness, lack of comfort, time uncertainty, lack of control, unreliability, long waiting times, need of transfers and lack of flexibility. On the other hand, the disadvantages of using private cars include parking difficulty, cost of parking, stress of driving, pollution, isolation and traffic. On the basis of those advantages and disadvantages, it is imperative that public transportation systems be analysed in terms of their strengths and weaknesses so as to implement a system that satisfies all categories of passengers and increases its market share as a whole (Anwar, 2009). Essentially, an effective public transport system should be capable of undoing the imbalances in terms of usability or accessibility (Antonio, 2014).

3.0 Methods

3.1 Research Design and Study Area

Anwar (2009) argues that developing and implementing a transportation system that offers a wide range of service quality elements is a complex task because it is inherently affected by human behaviour and attitude. With this in mind, the study adopted a descriptive design to explain the key factors that commuters prioritise to influence shifting towards using BRT. These factors influence present and future success of soft transportation policies cantered on encouraging the BRT system in Dar es Salaam. Dar es Salaam was selected as the focal study area because it is undergoing infrastructural reconfiguration to set aside BRT lanes exclusively for offering public transport. This study used the BRT phase one that is fully operational as its study area to examine the response of city dwellers to the BRT system. The phase one BRT system is made up of 20.9 kilometres of trunk routes and 57.9 kilometres of feeder routes. Therefore, the respondents for this study were selected along the trunk routes and feeder routes of BRT phase one.

Figure 1.0 BRT phase one map



Source: DART (2014)

3.2 Sampling and Sample Size

Given that the study was conducted along the BRT phase one routes, it was impossible to establish accurately the population of inhabitants residing along the BRT phase one routes. Hence, the study used a formula to estimate sample size with an unknown population size. Estimation of sample size with an unknown population size follows the following formula derived from Smith (2012) with n being the sample size, z being the Z-score, σ being the standard deviation and e being the margin of error.

$$n = \frac{Z^2 \times \sigma \times (1-\sigma)}{e^2}$$

With a confidence interval of 95%, standard deviation (σ) of 0.5 and margin of error (e) of 0.05 and Z-score at a given confidence interval being 1.96, the estimated sample size was 385 inhabitants. The sampling procedure used for this study was simple random sampling because any inhabitant residing along the BRT phase one routes had a chance of being included in the study.

3.3 Data Measurement, Collection and Analysis

On the basis of literature reviewed, the measurement variables to determine the expected efficacy of BRT system were pleasantness of BRT buses, pleasantness of BRT stations, waiting time on traffic junctions, presence of pedestrian crossing, usability of overpass bridges, bus availability, safe boarding, fare affordability and stability, travel schedule compliance, crowding of buses, getting a seat, safe travel, freedom from theft, drivers' professionalism, empathy of operators, polite language, waiting time at stations, assistance in emergency situations, usability of BRT buses to people of all kinds, boarding with cargo, economic uplifting and social life improvement. These 23 variables were measured at an ordinal scale with a five point Likert scale ranging from Strongly Agree to Strongly Disagree. The data were collected by means of a questionnaire which was circulated to inhabitants dwelling around the BRT phase one routes. Data were collected from inhabitants found on parking lots, stations, residential places and business centres along the BRT phase one routes. To avoid including passing by respondents, prior to providing copies of the questionnaire, respondents were asked about their permanent places of residence. If the response about place of residence was not along the BRT phase one, the respondent was regarded as a passer-by and not included in data collection. Data were collected along trunk routes and feeder routes. Descriptive analysis and Exploratory Factor Analysis (EFA) were used to analyse the collected data.

4.0 Findings

4.1 Demographic Characteristics

Table 1 shows the findings pertaining to demographic details and introductory questions to commuters' travel behaviour. According to the results, 55.6% of respondents were male whilst female respondents were 44.4%. Also, on the basis of respondents' education level, the findings showed that the majority of the respondents had a Bachelor's Degree (45.7%) followed by Diploma holders (23.9) and Master Degree holders (14.3%). In terms of age, the majority (58.4%) of the respondents fell in the age category of 21 to 30 years, followed by 26.8% of the respondents who fell in the age category of 31 to 40 years. The study also established the initial travel behaviour of the respondents by determining the frequency with which they commuted to the central business district (CBD). The results showed that 89.6% of the respondents were making frequent trips to the city centre whilst 10.4% of the respondents contended that they didn't make frequent trips to the city centre.

Table 1: Demographic descriptive results

Variable		n (%)
Gender	Male	214(55.6%)
	Female	171(44.4%)
Age	Below 20	25(6.5%)
	21-30	225(58.4%)
	31-40	103(26.8%)
	41-50	23(6.0%)
	Above 50	9(2.3%)
Education level	Primary education	15(3.9%)
	Secondary education	43(11.2%)
	Ordinary diploma	92(23.9%)
	Bachelor degree	176(45.7%)
	Master degree	55(14.3%)
	Doctoral degree	4(1.0%)
Frequency of trips	Frequent commuter trips	345(89.6%)
	Infrequent commuter trips	40(10.4%)

4.2 Pre and Post BRT Modal Split

The study established the primary mode of transport preferred by commuters when making inner city movement before and after commencement of BRT public transport service. The results showed that, pre-BRT, the modal split was constituted by public transport/daladala (80.8%), private vehicles (10.9%), motorcycle/bodaboda (6.0%), walking (1.6%) and cycling (0.8%). Post-BRT, the modal split was constituted by BRT buses (39.7%), daladala (38.7%), private vehicles (15.6%), motorcycles (4.9%) and walking (1.0%). Further, findings showed that there was an increase in private vehicle usage by 42.9% even after the commencement of BRT. Also, daladala usage for commuting purpose had shrunk by 52.1% since the BRT became operational. Generally, post-BRT modal split shows that there were 232 (60.3%) commuters who made their trips using transport modes other than BRT.

Table 2: Modal split

	Walking (%)	Cycling (%)	Motorcycle (%)	Private vehicles (%)	Daladala (%)	BRT (%)
Pre-BRT	6(1.6%)	3(0.8%)	23(6.0%)	42(10.9%)	311(80.8%)	-
Post-BRT	4(1.0%)	-	19(4.9%)	60(15.6%)	149(38.7%)	153(39.7%)
% change	(33.3)	-	(17.4)	42.9	(52.1%)	-

The findings showed that, pre-BRT, the majority of commuters used to make their trips using daladala. Also, the findings showed that, after BRT commenced operations, daladala commuters constituted the majority of commuters who switched to using BRT. The inclination of daladala commuters switching to BRT proves that the group was mostly affected by daladala inefficiencies. These findings are in line with Helberth and Kimambo (2020) who suggested that the majority of daladala users switched to use BRT buses. On the contrary, even after introduction of the BRT system, there was an increase in private vehicle usage. These findings align with the findings by Al-Shaar et al. (2022) who found that, in Lebanon, the BRT system was supported by pre-existing public transport users. In addition, the tendency of commuters switching to owning and commuting by means of private vehicle upholds the notion held that expansion of roads increases private vehicle usage. With increased private usage, it is hard to fully exploit the advantages of public transportation; it is a matter of time before traffic congestion worsens beyond tolerable levels. Concurring with these findings are the findings by Da Silva (2014) and Zarabi and Waygood (2021) who reported that vast road network isn’t the solution to promote efficient urban mobility, but it rather increases congestion problems because it promotes abandonment of public transport.

4.3 Variability of BRT Bus Service Quality Perception

After the BRT commenced operations, commuters started making their trips using BRT. The results showed that 374 (97.1%) have at least once used BRT whilst 11 (2.9%) had not yet used BRT. The commuters who had at least once used BRT provided an objective assessment on service quality perception. A

Kruskal-Wallis test was used to establish the variation in perceptions on quality of services offered by BRT buses. To establish the similarity in perception, the study compared the perceptions on quality of services based on the pre-BRT primary mode of transportation (walking, cycling, motorcycle, private vehicle and daladala). The results showed that there was a statistically significant difference in the perception of quality of service on the presence of multiple pedestrian crossing zones [H(4) = 13.791, p = 0.008] and BRT buses being usable to people of all kind [H(4) = 18.064, p = 0.001]. On the rest of quality of service aspects, there was no statistically significant difference, which means commuters perceived similarly the quality of service aspects. Further, the effect size was computed, and the results showed that there was a medium effect size or influence of pre-BRT modal usage on the variability of service quality aspects perception. The effect size was regarded as small to medium, according to the ranges 0.02 < ES < 0.26 provided by Cohen (1992). These findings oppose the findings by Chaudhary (2020) who argued that, in India, commuters' perception on service quality varied significantly across all demographic cohorts, except age of respondent and frequency of usage. The difference in the findings could be attributed to the difference in contexts whereby India differs significantly from Tanzania in terms of demographics and development profile.

Table 3: Perception difference on quality of service of BRT buses

Variable	H	df	Asymp. Sig.	Epsilon Squared
Pleasantness and conduciveness of buses	2.451	4	0.653	0.007
Pleasantness and conduciveness of stations	7.440	4	0.114	0.020
Fast-tracking BRT buses at traffic junctions or stops	4.748	4	0.314	0.013
Presence of multiple pedestrian crossing	13.791	4	0.008	0.037
Usability of overpass bridges to people of all kind	4.875	4	0.300	0.013
Availability of buses at all times	7.631	4	0.106	0.020
Easy and safe boarding of buses	3.610	4	0.461	0.010
Easiness of ticketing system for buses	2.742	4	0.602	0.007
Affordable and stable bus fare	7.229	4	0124	0.019
Buses complying with travel schedule	6.950	4	0.139	0.019
Overcrowding of buses	7.093	4	0.131	0.019
Availability of seats for comfortable travel	6.479	4	0.166	0.017
Less risk of accidents	2.225	4	0.695	0.006
Less risk of theft and pickpockets	3.939	4	0.414	0.011
Professional bus drivers	2.868	4	0.580	0.008
Empathy of bus operators and service providers	2.267	4	0.687	0.006
Bus operators are using polite language	7.830	4	0.98	0.021

Waiting time for buses at stations	0.782	4	0.941	0.002
Getting assistance in emergency situation	1.180	4	0.881	0.003
Usability of buses to people of all kind	18.064	4	0.001	0.048
Boarding with cargo without incurring additional cost	1.356	4	0.852	0.004
Enabling on time arrival at work or business place	4.686	4	0.321	0.013
Reducing time spent on road hence improve social life	5.077	4	0.280	0.014

4.4 Factor Analysis

Meyer-Olkin (KMO) test and Bartlett's test of sphericity were conducted to determine the suitability of the data for factor analysis. The KMO statistic was of 0.929, indicating that the sample was adequate and variables had communalities. Bartlett's test of sphericity gave a significant value (p = 0.000) which implies that there was substantial correlation in the data. Of the 23 variables studied, the communalities were above 0.30, which means that factor analysis was appropriate.

Table 4: KMO and Bartlett's test of sphericity

KMO measure of sampling adequacy		**0.929**
Bartlett's test of sphericity	Approx. Chi-square	3624.469
	df	253
	Sig.	0.000

Principal component analysis was conducted for the 23 variables, and it produced a four factor solution. Two variables were discarded because they didn't load with any factor at the given factor loading of 0.50. The discarded factors were perceived affordability and stability of bus fare and usefulness of overpasses. Thus, the remained extracted factors explained 57.947% of total variance. However, one factor (factor 4) contained fewer than three variables; hence it was not considered as a factor (Costello & Osborne, 2005).

Table 5: Factor and reliability analysis of BRT's quality of service perception

Variable	Factor 1	Factor 2	Factor 3	Factor 4
Enabling on time arrival at work or business place	0.712			
Buses complying with travel schedule and do not stay for long at stations	0.645			
Bus operators providing assistance in an emergency situation	0.638			
Allowed to board buses with my luggage without additional cost	0.617			
Wait for shorter period of time at station before boarding a bus to destination	0.584			
The ticketing system is friendly and get a bus ticket conveniently	0.579			
BRT buses can be used by people of all kind and walks of life	0.574			
Reducing time spent on road hence improve my social life	0.553			
When boarding BRT buses, I would like to get a seat at all times		0.710		
I can wait and board BRT buses without worrying about theft and pickpockets		0.671		
BRT bus operators using polite language when addressing passengers		0.630		
BRT operators demonstrate empathetic feelings towards passengers		0.629		
Boarding BRT buses involves scrambling that can cause injury		0.616		
Availability of BRT buses during peak and off-peak hours		0.562		
BRT infrastructure includes multiple pedestrian crossing to facilitate safe pedestrian movement and crossing			0.692	
Safer travels with BRT buses with less risk of minor or major accidents			0.676	
Conduciveness of stations and boarding platform to all kinds of passengers			0.645	
Pleasantness of BRT buses as they are cleaned and appropriately sustained			0.606	
Bus drivers do not drive recklessly and they consider road traffic post signs			0.553	
Overcrowding of BRT buses is not conducive for health and safety reasons				-0.788

Fast-tracking BRT buses at traffic junctions or stops				0.542
Cronbach's alpha	0.862	0.824	0.757	-
Eigenvalue	8.123	1.792	1.216	1.038
Percentage (%) of variance	38.68 2	8.534	5.790	4.941
Mean	3.228	2.723	3.621	3.487
Standard deviation	1.170	1.179	0.997	1.211

The findings pertaining to factor analysis results are discussed on the basis of the extracted factors and the attributes that loaded on each of the extracted factors. The final factor solution retained three factors that represented the valuable factors that commuters perceives as important to encourage their usage of BRT. The three remaining factors are labelled and explained as follows.

Factor 1, termed as travel time reduction and reliability, had a loading of eight variables. The reliability analysis of the factor was conducted, and the Cronbach's alpha value was 0.862. This factor accounted for 38.682% of variance, and the eigenvalue was 8.123. The variables with higher loading imply that commuters gave them high priority. Commuters prioritized that BRT buses should enable them to arrive on time at their income generating activities places. The findings drew that commuters highly valued the travel time reduction because travel time related variables loaded on this factor. Commuters believed that BRT should always enable them to arrive on time at their workplaces; buses complying with travel schedule as they don't stay for long on stations and commuters don't wait for long at stations before boarding buses. These findings are congruent with the findings by Andrew et al., (2022) as they argued that BRT trips had the lowest average travel time (16 minutes), followed by private vehicles (18 minutes), and daladala had the longest average travel time (28 minutes). Further, Balboni et al. (2019) found that people were slightly satisfied with travel times as movement to the city centre decreased from 122 minutes in 2016 to 83 minutes in 2019. Loading on this factor was commuters' valuation of having to wait for shorter periods of time prior to boarding buses. These results imply that commuters are spending long waiting times prior to boarding buses. These findings concur with findings by Chengula and Kombe (2017) who reported that commuters are exposed to long waiting times for buses, especially during off-peak hours.

Factor 2 was named service accessibility and assurance with loadings of six variables. The Cronbach's alpha for reliability was 0.824. This factor accounted for 8.534% of variance of the data, and the eigenvalue was 1.792. Commuters highly valued the possibility of getting a seat and being protected against theft and pickpockets both at stations waiting for buses and en route. Commuters placed huge importance on getting a seat when traveling so as to be free from physical discomfort and to enjoy the ride. These findings aligned with the findings by Preston et al. (2017) that passengers feel that lack of space and inability to get a seat in public transport causes physical discomfort and increased stress levels. Further, commuters valued security to protect them against theft and pickpockets. This means that commuters are worried that security in BRT is less robust. These findings are supported by Munishi et al. (2021) who suggested that commuters using BRT services were worried about theft and pickpockets; they reported that their wallets and mobile phones went missing during trips.

Factor 3 was referred to as trip safety and physical aspects, with loadings of five variables. A reliability analysis test was conducted, and the Cronbach’s alpha value was 0.757. Further, this factor contributed 5.790% to the variance of the data, and the eigenvalue was 1.216. The attribute that loaded highly was presence of pedestrian crossings to guarantee safety of on-foot by-passers. Also, commuters highly valued safe travelling with less probability of suffering road accidents. Such findings pertaining to valuation of physical aspects and safety by commuters were also echoed by findings by Kruger et al. (2021) who reported that local residents interviewed mentioned an increase in safety with BRT is pivotal as compared to previous daladala. Further, they argued that BRT infrastructure has been fairly designed to accommodate pedestrian paths and pedestrian crossing that reduced the risk of potential accidents. On this factor, the conduciveness of BRT stations and boarding platforms loaded which translates to commuters valuing this aspect. Kruger et al. (2021) suggested that BRT boarding situations weren’t conducive to physically impaired and handicapped people.

5 Conclusions and Recommendations

5.4 Conclusions

This study established the long term success possibility of reducing urban congestion by encouraging public transport usage. To determine the possibility of voluntary shift, the study assessed the key factors that commuters value significantly when making their inner-city trips using BRT. The focus was mainly on assessing the effectiveness of the BRT system in attracting widest range of commuters by considering various service quality aspects as perceived by commuters. After BRT services became operational, there has been a significant reduction in daladala usage as more of daladala commuters switched to using BRT. The striking thing is that even after BRT services commencing operations, there has been an increase in private vehicle usage along the same corridors where BRT network of infrastructure is available. This informs decision makers that BRT services haven't managed to attract private car users to switch towards using BRT services. Also, the persistence in using private vehicles along the BRT corridors suggests that the expansion of road infrastructure like construction of fly-overs has reduced driving costs, which motivates private vehicle use. The results depict that even after the introduction of BRT services, there has been a generally lower level of commuters using BRT as a primary commuting option. The low adoption rate of the BRT system signifies that, currently, the system is not operating at its full potential. This means that commuters perceive that the BRT system does not fully meet their expectations on key factors they perceive as important to fully encourage their voluntary shift to BRT usage in terms of travel time reduction and reliability, accessibility and assurance as well as physical aspects and safety.

5.5 Recommendations

To be able to encourage successful implementation of soft transportation policies that advocate voluntary shift towards using public transport services, concerted efforts must be made to improve the quality of service offered by BRT buses. Deliberate efforts should be made by policy makers and urban transport planners that focus on improving the overall quality of services by BRT buses, both on the current operational corridors and in the forthcoming phases that are currently under construction. Whilst the findings have shown that commuters highly perceive the reduction of travel time, BRT buses have managed to reduce en route travel time but not the total travel time. With total travel time it means considerations also on reducing waiting times at stations prior to boarding buses. Along the phase one BRT corridor, BRT buses are competing against private vehicles and daladala operators. The existence of daladala operators along the BRT corridors affects the profitability of BRT services because BRT buses aren't as flexible as daladala and private vehicles. Thus, it is crucial that policy makers devise strategies of improving BRT services and phase out daladala operators so as to ensure sustainability of BRT services. Further, plans to expand roads towards the city centre should be shelved because the expansion reduces driving costs and thus induces driving behaviour which will, with time, bring about congestion problems. Improving the quality of service offered by BRT buses is essential to foster voluntary shift in travel behaviour for both daladala and private vehicle users. However, to sway the daladala and private vehicle users towards using BRT buses may require the BRT services to be more flexible. Flexibility in this case translates to route coverage. Flexibility of BRT buses can be achieved by operating along the trunk and feeder routes according to the service conception. Also, BRT buses should maintain the same level of services during off-peak and peak hours.

6 Scope limitation

This study focused mainly on establishing the influence of quality of service of the newly established bus rapid transit system to sway commuters towards using public transport. The implementation of the BRT system to encourage commuters to use public transport is one of the variants of soft transportation policies. Thus, this study only considered the pull of public transport towards reducing private vehicle use which in turn brings about long term decongestion benefits. Other soft transportation strategies like traffic tolls, parking charges and others were not considered for this study.

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