Passenger Perceptions on Reliability of an Inter-Campus Bus System

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Abstract - **Passenger perceptions about reliability are influenced by a number of factors. These factors include average lateness, excess wait time, and buses arriving on time, buses cancelled and buses departing on time. Literature, informs us that passengers have different perceptions about lateness, excess wait time, and buses arriving and departing on time and cancelled buses. Over 60 % of employed South Africans rely on public transport. The research question is, what are the important reliability indicators are for passengers of a University transport system? Extensive research has been done in the areas of transport reliability, but not in the field of transport designated for students. Engineered systems may fail, especially in passenger transport if the perceived value is not experienced by passengers. Among other findings, is that passengers place a great value on the bus schedule times and how those are communicated.**

Keywords − **Automatic Vehicle Locator, Bus Services, Expected Waiting Time (EWT), Reliability, Passengers,**

I. INTRODUCTION

An institution like the University of Johannesburg has student societies which work with lower budgets and attend meetings, functions and gatherings in different campuses from time to time using the intercampus bus shuttle service. It is not only students who make use of the Inter-campus bus shuttle service; contractors' staff and the university's staff members as well. Some of the passengers ride on buses also to be brought to campuses near their residences. The bus users or passengers, particularly students rely on the Inter-campus bus shuttle service [1] to be on time as indicated on the schedule, however, the buses are sometimes not on time, sometimes on time but full they also bunch and also early or late than specified on the schedule and other buses wait at the stations to be full, delaying the on time passengers as stipulated on the bus schedule. The concern about reliability, extends further to the bus services during the last days of a term or semester when drivers decide not to adhere to the prescribed schedule with an assumption that the demand is low since not many students are seen on campus. The buses during the last days of a term or a semester get slower, delayed and even bunch deliberately. Reliability is the propensity to perform consistently over the service time [2]. Students also depend on the reliability of the buses to be on time and it is therefore essential that the schedule is adhered to, as it entails the Expected Waiting Time (EWT) and students plan around this time. The routes used also determine the time spent on the bus ride and drivers who drive at inconsistent speeds are sometimes perceived by the bus users as the source of unreliability any bus system, moreover the waiting time on queuing is also another bottleneck in the delivery of the Inter-campus bus shuttle service. Because of this students become impatient, some even late and when the buses arrive at their designated stations, students push and distract the queue in order to get into the bus and this gets to undermine the role of queue marshals. This paper consists of a research methodology, results, recommendations, limitations and conclusions.

Reliable public transport service plays an important role in transporting people from one location to another, especially in the major cities of South Africa, a transport system is responsible for linking the Area of Origin (AO) and the Area of Destination (AD) and this activity is expected by passengers to take place in a most reliable manner [3]. Passengers who pay a fare for a bus service they demand or expect that the services will be fast in taking them from one destination to another and it is the same with those who pay a less expensive or in a free bus system, however, the preferences for the speed of bus services differ among the passengers on the basis whether they use passenger fare or non-fare passenger bus services; which could include staff bus services or those services not paid for directly [4]. A bus transport system is not complete without schedule times that are accessible to passengers and in this era of technology, most service providers have reverted to making available their transport schedules on accessible websites and mobile sites [5]. The major concern that passengers always have is how dependable are the transport services and in this literature we use transport reliability factors to provide the theories on the need for a dependable transport. Reliability of a passenger bus transport can be measured using nine reliability indicators, for this literature we review five [6] which includes the frequency of buses cancelled, buses departing on time, buses arriving on time, excess wait time, average lateness. These indicators are the variables that determine whether a transportation system, particularly, the public passenger transport is reliable or not. These indicators all have impact on the passengers' Value-Of-Time, which refers to the value of activities that passengers would be engaged in if not in transit or waiting at bus stations to commute or for buses that are out of schedule [4]. Following is a closer review of these reliability indicators.

A. Bus services cancelled

Cancellation of scheduled bus services has negative implications for both the service provider and the passengers [6]. In a case of outsourced bus services, cancelled services will decrease the reputational value of the service provider and discredit trust by the client and also have financial repercussions. It should be noted that in this literature the term students and passengers is used interchangeably, for students cancelled services will increase their waiting time, make long the queues and there will be lateness for classes and other appointments. The portion of the waiting time could have been spent in libraries, home or in an office if the bus schedule is followed accordingly [3]. The operators, because of the frequency of the buses might be unable to issue notices for cancelled bus services. In other transport literature websites linked to Automatic Vehicle Locators had been discussed as possible solutions to communicating the out of schedule or cancelled buses [5]. The cancelled buses also have an impact on the perception that passengers get to have about the bus operator and transit time also prolongs the arrival to the next deboarding station [7].

B. Buses departing on time

Both passengers and management easily understand on time departure as a measure and sign of a reliable bus system [6]. Drivers could speed up if they running late for the next station or even slow down if they are too early for the next station or even slow down if they are too early for the next station given that departure time is seen as a common measure of reliability by student-passengers [7]. Time Schedule adherence is essential to the student passengers as they rely on it for planning their time and they are more concerned about departure time than arrival time given the interferences that can occur on the road. Those regular passengers are highly aware of the mean and variance in the travel times, as well as deviations that occur on certain times and regular passengers are those passengers who travel to the same destination regularly [18]. Cutting-route is a strategy used to make shorter the routes which ensures the use of the shortest possible routes to reach the stations that follow [8] and other passengers with alternative transport options switch to those depending on the time difference from the arrival at the bus station time waited [3]. In relation to the departure time next is the review of the bus services arriving on time which is also a measure of time reliance.

C. Bus services arriving on time

Bus services operate from the planned time schedules and these schedules indicate both departure and arrival times and with these two times student passengers determine the time that would be spent on trip. There is also a time difference [6] between departure and arrival times at bus stops which refers to the boarding and the deboarding of passengers. The timely arrival of buses is one of the convenient attributes that passengers are constantly in need for when making use of public passenger transport systems as it is easy to measure on the basis of timely arrival whether the services are dependable or not [9]. Customer satisfaction may experience detraction if a passenger has to spend most of his or her time in the bus transport service compared to other day tasks [5] and organisations running commuter transport systems need to improve on service reliability to attract further users and in this way they will contribute better in reducing congestions, air pollution, noise and other traffic problems when more people make use of private transport due to unreliable bus or commuter transport systems [9].

D. Excess Wait Time

When the waiting time period is longer than the time indicated on the time schedule, which is referred to as EWT [6]. Excess Wait Time is also a result of the variability in traffic, boarding and deboarding of passengers [10]. Larger gaps in the bus arrival and departure intervals allow more passenger arrivals, and passengers wait longer than average, this is a result of bus bunching which refers to buses arriving at the same station close in time and delay deliberately to open up the time gap again as prescribed on the schedule. Fu and Xin (2007)[3] assessed the performance of bus services on the basis of a performance index referred to at the Transit Service Indicator (TSI), which has a strong relation with this particular research study. The TSI is an integration of multiple performance measures which include service frequency, hours of service, and route coverage and travel time components within a systematic transport framework. The Structural Equation Model in passenger transportation systems emphasizes the importance of improving those service quality attribute that passengers regard as essential indicator of the reliability of transport services [9], passengers are less concerned about the time spent on transit in certain instances because they are more likely to see what is impeding the driver from escaping the traffic flow or congestion and any other road conditions [3]. The next factor is average lateness in this broad subject of the transport reliability.

E. Average Lateness

Bus transport services are used by passengers who are travel to and from their AO and AD [3]. Furthermore, the AO are commonly homes, apartments, residences or rented residential areas, in the morning hours it is common to have passengers commuting to the Central Business District where they work, study and do other activities [3] [11] which in this study refers to the Lateness refers to the late arrival and even not getting notifications about the bus delays occurring. According to Currie et.al 2012 [6] average lateness is the degree of the out of time lateness and which can be measured based on

the time schedule. According to Monchambert & Palma (2013)[11] commuters adapt to a transport system and in case of a bus transport system which has low fares than other transport modes the tolerance for the late bus arrivals is greater and passengers or commuters adjust their time to get earlier buses to be earlier for their AD. For a bus service it is average lateness but for a passenger or a commuter the average lateness of a bus translates into average waiting times and according to [12] the average waiting times or lateness of a transport system, in this case buses is influenced by different routes at peak and off peak periods.

All of these variables determine the reliability of the bus performance against the scheduled time. Mosca and Zito (2011)[13] recognize that the infrastructure, referring to waiting areas or bus stops and roads, have issues since roads are shared with other vehicles and sometimes with pedestrians as a result this affect the quality of a service. It is therefore essential to measure the performance of the programs and investments made by an organization with an aim to reach certain targets e.g. deliver passengers on time [10]. Reliability is an important feature of quality to public transport [14].

The diagram below shows the factors impacting the reliability of a bus transport service [6]
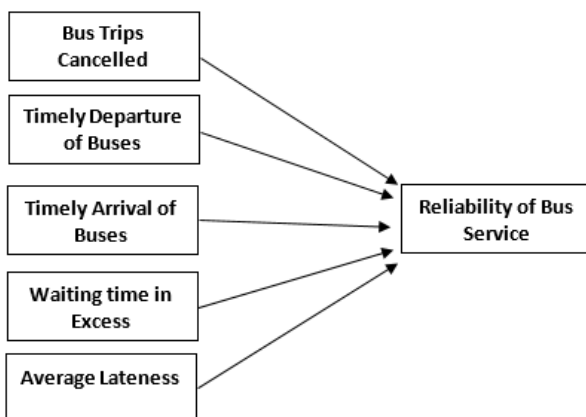

Figure: 1 Bus Shuttle Service Reliability Measure Model

This diagram shows that for the bus service to be reliable these five factors or independent variables that should be considered and in measuring reliability of a public or a bus transport service. The cancellation of buses with or without notification can cause passengers to wait longer, some passengers if they frequently make use of the bus service they may not even consider checking the schedule; than they would do if they were infrequent users of the bus [7]. In as much as a bus has to depart and arrive on time, passengers should think about other co-passengers at the bus stop and also allow time for the unexpected events that could cause the bus services to be delayed or even be cancelled. The departure time of the buses is affected by the time the bus spends boarding and deboarding passengers and passenger movement that gets hindered by those on the bus, therefore the stop time for the bus becomes longer at each station, affected by the boarding and deboarding passengers [10]. With systems such as the Automatic Vehicle Location (AVL) systems deployed by bus operators which track the real time locations of the buses and these working efficiently buses are ought to be on time [7]. Average passenger waiting time is widely used to measure a multi-user road based bus service reliability. In the study of the interaction of demand and supply side's components [14] it was evident that passengers upon arriving at a bus stop of a frequent bus transport they demand to depart in a short period of time.

All these variables bring to the fore the need for reliable public transport service [7] and a need for realistic bus schedules. The lacking provision of real-time information about buses at stations create negativity about a bus system and passengers become uncertain most of the time about the times of the bus service. Poor infrastructural waiting conditions are also contribute to the passenger's dissatisfaction about bus services [16]. In the sections that follow we look at the possible reasons found in literature about the needs of safe passenger bus services and the promotion of mass transport services to reduce air pollution, noise and congestion. This literature review gives a broader understanding of the passenger bus systems. The chapter that follows is the research methodology which will give a practical understanding of this research study, how it was conducted and also the used instrument in collecting data. The research methodology will also respond to the question about the type of study that this research study falls under.

II. METHODOLOGY

The quantitative and qualitative [19] research approaches were employed in this study. The research presents essential statistics on the users' perceptions. The research instrument used a Likert scale rating between 1 to 5 and also used the different extremes, such as "not often to most often" or not "important to very important" and other extremes. The study was conducted at the UJ's four campuses and from a population of 12 000 students (UJ Transport dept.) who commute with the buses and a sample of 25 students per campus participated in the study, an additional 25 students in the Doorenfontein Campus because of the new bus route that was added from Soweto Campus to Doorenfontein Campus. Participants were only the students who make use of the UJ Intercampus Bus Shuttle Service and an anonymous questionnaire was used. The research questionnaire collected data about the characteristics and the habits of the passengers making use of the UJ Intercampus bus shuttle service and the study served as an assessment of which important characteristics of reliability are important to the passengers. The selected reliability measurement indicators or factors were relevant to be used to measure the reliability of the UJ Intercampus Bus Shuttle service

and they are testable variables. The questionnaire used was also be formed with constructs that represented the five reliability indicators.

A sample that was used for the UJ intercampus bus shuttle service was 121 students and 25 students per campus formed part of the sample and at DFC 50 students were given an opportunity to participate because of the new late from SWC-DFC. The questionnaires were administered in the library to students and those in the queues and the questionnaire was tested at SWC and it was observed that the questionnaire took only 5-7 minutes to complete.

III. RESULTS

The hypothesis here was proven to be true as 75% of the participants noticed that delays in bus arrivals contributed to the crowding of bus stations. Cancellation of the buses does impose extra waiting time for the passengers [3] and cancellations signal unreliability of the bus services and may increase crowding for the following buses which are on schedule [8] and schedule reliability is a central point to reliability or a service level agreement, it is true in this study that the cancellation of scheduled buses in a busy route increases crowding for the next bus on schedule.

Bus departing and arriving on time can satisfy or cause passengers' dissatisfaction [17]. In this study 31% of the participants were in strong agreement that the buses never adhere to time schedules. In previous researches it is evident that timely departures and arrivals were important to passengers [7] and the proposed research will be based on a bus operation that has interlinked bus stops, meaning being on time for the first bus stop increases the chances of being on time for the next bus stop. Another hypothesis is proven true by this study that passengers' satisfaction increases if the buses adhere to the bus schedule.

Passengers are prepared to wait for a bus, but for a certain time period. The Excess Wait Time refers to when the interval between buses is longer than indicated on the time schedule [6] and gaps because of waiting become larger and more time is allowed for more passengers to arrive which crowd the bus stops, eventually disputes break out among passengers [10]. A hypothesis derived here is that the more time passengers have to wait for late buses the arrival of passengers increase and the waiting experience becomes negative. This hypothesis is proven true by the following statistics in the case of the UJ Intercampus bus shuttle service.

- 75% of the participants noticed that delays in bus arrivals contributed to the crowding of bus stations.
- 49% of the participants used intercampus bus shuttle service to attend classes.
- A total 48% of the participants their trust for the bus services.

This hypothesis could not be proven true or untrue by this study as 33% of the participants were unsure of the time spent in excess or in transit from one point to the other and whether it was acceptable or unacceptable. It is normally, challenging to see whether a bus is late or not when it is part of a frequent bus system and when passengers are no longer concerned about the schedule because of the frequency that buses arrive. But lateness can occur on the travel time [6]. A hypothesis which was if more time is wasted on board the reliability decreases.

The above discussion of hypotheses in relation to the results of this study shows that the study has addressed its proposed intentions, in the following section results are used to answer the research question of this study.

A. Discussions and Recommendations

The study shows that at least 98% of the participants who make use of the bus services are black and it shows that students from the UJ Accredited off campus residences are also using the bus services, whereas the owners of these residences are required to provide transport for their tenants, furthermore is that the passengers of the UJ Intercampus bus shuttle service would be satisfied if the following could be improved:

- Increase buses adherence to bus schedule (Timely arrivals & Departures): 31% of the participants were in strong agreement that the buses never adhere to time schedules, only 5% of the participants strongly believe that the buses adhered to bus schedules. The failure of buses to adhere to the prescribed schedules 75% of the participants noticed that delays in bus arrivals contributed to the crowding of bus stations and which has a negative impact on the experience of the passengers. Deliberate bunching should be monitored timeously especially on peak times.
- Management of the queuing systems: 34% of the participants weren't satisfied with the manner in which the queuing systems are managed, this refers to the monitoring of queues by the marshals that no other passengers get in front of the long-time queuing passengers and the ability to improve on the ease of following the queuing procedures at the stations.

About 49% of those who participated in the study make use of the UJ Intercampus bus shuttle service, this shows a need for further investigation by the UJ Transport Division on what do the other students make the use of bus services for, it is easy for most students to ask for more buses, while the current buses system in place is not used for the intended purpose.

IV. CONCLUSION

It is essential to improve the performance of a public transport system to attract more people into using such systems. A move to the public transport system will also

address todays environmental challenges which are caused by air pollutions resulting from excessive release of smoke by vehicles and industries. Moreover, passengers should be able to gain value for money through public transport especially the bus systems. Therefore it will take a great effort to convience passengers that the intercampus bus operations may be relied upon until they present the additional recommendations as recommended here. The limitations of this study is that the sample size was relatively small and a thorough factor analysis still needs to be completed.

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