

## Perspectives of the stakeholders of the public transportation system on ICT solutions applicability in the Free State, South Africa

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### ABSTRACT

Information Communication Technologies have recently been adopted by transportation systems around the world to improve their services. In adopting these technologies, the stakeholders' involvement and perceptions regarding ICT should be considered. This paper, considering the study area, reflects on the perceptions of different stakeholders of the public transportation system towards the introduction of ICT solutions to the system. The methodology adopted was to understand the expectations of drivers, passengers and operators on integrating ICT solutions into the public transportation system, focusing on mini-bus taxis and Interstate Bus Line buses. The significant results of the study show that ICTs are anticipated and long overdue development to the system but the stakeholders have varying expectations. These results reflect on the priorities of the stakeholders, i.e., passengers yearn for improved service quality; drivers are concerned with their working conditions while the operators' interests are profit motivated. This paper highlights the ICT interests of passengers, drivers and operators. It compares passengers' needs, in terms of technologies, to improve the public transportations system against what the operators are enthusiastic to provide.

**Keywords:** Information Communication Technologies, Perception, Public Transportation, Stakeholder

### INTRODUCTION

Stakeholders' perceptions on technology play a crucial role in the adoption of ICT in the public transportation system. Enabling actions for successful deployment of ICT in transportation should include a consensus amongst the stakeholders (Idongesit & Knud, 2014). The goal of public transportation services is to provide safe, reliable, affordable and accessible public transportation to the public. The main concern of the stakeholders should be that the above factors are met. In the Free State, public transportation is provided by private mini bus taxi operators and bus services which are provided by a private company under government subsidy.

Although public transportation systems in the world have been taking advantage of the current technological momentum to improve their service provision, the Free State public transportation system have not done much yet to exploit the opportunities lying within ICT. Deployment of ICT solutions to improve the public transportations system in the province may however be anticipated by the different stakeholders for solving differing problems in the system and how they may improve their different affiliations to the public transportations system.

The uptake will also depend on how drivers view the development (Zwick, 2002). Innovations render knowledge obsolete, therefore forcing employees to undergo training in order to be able to adapt to the changes. Public transportation drivers will require training in order to use some of the new technologies.

With the public transportation systems facing problems of safety, lack of information, accessibility, and being unreliable; operators should be concerned with eliminating these

problems to satisfy the needs of customers and improve the system for the passengers. The concerns of the operators may not be aligned with those of drivers and operators based on their different needs. The role of the operators, as the service provider is to ensure that the passengers and drivers are safe, they provide regular service for reliability. Service provision, in general, should be inclined with fulfilling customer needs other than protecting the operator's investment.

### **ICT Opportunities for Stakeholders in public transportation systems**

ICT has the ability to improve the efficiency and effectiveness of public transportation systems, therefore improving mobility for the passengers, working conditions for drivers, and service delivery for operators. ICT has improved public transportation through technologies and applications in different scenarios:

#### *Real time information through map and route display screen and trip planning applications*

Passengers would use display screens for information on their location, time left to their destination, routes they are travelling on. This would reduce cases of inaccessibility of public transportation due to lack of information on routes in a sense that, a novice would have all the information they need made available through these screens. Studies show that technologies allow real time information transference between travellers and public transportation service providers (Filippi, Fusco & Nanni, 2013), and that usability of public transportation can be improved significantly if good real time traveller information systems are provided (Ferris, Watkins & Borning, 2010). Provision of real time information will enable travellers to enquire about arrival and departure times at locations of their interest, and the availability of this information is a way of increasing public transport ridership as it reduces anxiety of passengers, therefore increasing a sense of reliability towards the public transportation systems (Ferris, Watkins & Borning, 2010; Park, Yang & Yi, 2011).

#### *Real Time Tracking and Monitoring of Vehicles*

Monitoring of bus stations, stops, and inside the vehicle is important for safety reasons. Currently, the method of payment in mini-bus taxis is such that passengers pass their fare to the person seated in front of them in the vehicle, in some cases money goes missing in the process without any means of tracing how and where it disappeared or identifying a passenger who did not pay. In these cases, the driver, who is the final designated recipient of the money, should be able to see, using CCTV as money is being passed around to solve this problem.

#### *Electronic fare payment (EFP) systems*

Electronic fare payments have made payment for journeys by public transportation more convenient and also made it easier for operators and bus conductors; improving public transportation for both passengers and service providers. These fare payment systems operate through electronic communication, data processing and storage techniques that have made manual fare collection an automatic, computerized system (Floridaapts, 2015). They have improved manual labour dealing with handling of cash, safety and security reasons as bus drivers and conductors do not have to be at risk of robberies and hijackings targeting the money collected from passengers. EFP methods include electronic ticketing and smart cards. They have provided a platform for accessibility of information on public transportation, meaning that public transportation has also become more accessible and safer. Information is very important to travellers especially those new to a place (Ben-Elia and Avineri, 2015).

**LITERATURE REVIEW**

**Passengers and drivers’ perspectives**

Public transportation users have the view that ICT solutions will improve the public transportations system tremendously, by improving accessibility, reliability and safety, and general quality of service. As ICTs can be used by operators or governments to monitor drivers, they can be used to both monitor and mentor drivers. Negative impacts of monitoring such as invasion of privacy and compromising driver behaviour shall be balanced by mentoring. Noting that most operators have shown interest in tracking and monitoring technologies like CCTVs, tracking devices and speed monitoring devices. Operators aims of managing their enterprises through ICT can influence the attitudes can go beyond perceptions of transparency, privacy and fairness to determine the degree of trust in the system (Regan, Horberry & Stevens, 2014).

The Technology Acceptance Model (Davis, Bagozzi & Warshaw, 1989) was adopted to explain possible links between determinants of computer acceptance and user behaviour, can also be adopted to determine acceptance of ICTs by users. The users, i.e. operators, drivers and passengers’, perception of how the technologies will be useful to them and how easy to use they will also determine their attitude towards particular technologies or applications. Perceived usefulness and perceived ease of use therefore are seen as the crucial factors determining acceptance. Perceived usefulness of technologies also influences the person’s behaviour with regards to their intention to use or not use the technology. This model, based on drivers’ perspectives, shows that drivers will accept technologies they assume will enhance their performance (performance expectancy) and improves their working conditions. Behavioural intentions (how the people intend to use the technologies) and their impact on the actual use of the technologies should also be considered. With all the stakeholder’s main concern being the usefulness and ease of use of ICT, consideration should be made as to whether those impacts are the same for all the stakeholders, i.e. what the other stakeholders consider useful, will it have the same positive impact on the other stakeholders, and will other stakeholders be able to easily use.

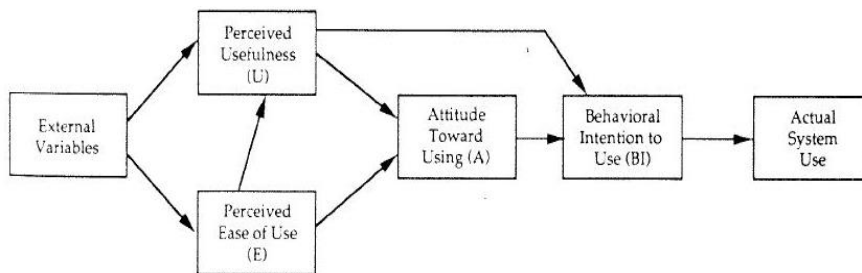


Figure 1: Technology Acceptance Model (Davis, Bagozzi & Warshaw, 1989)

**Drivers and operators’ perspectives**

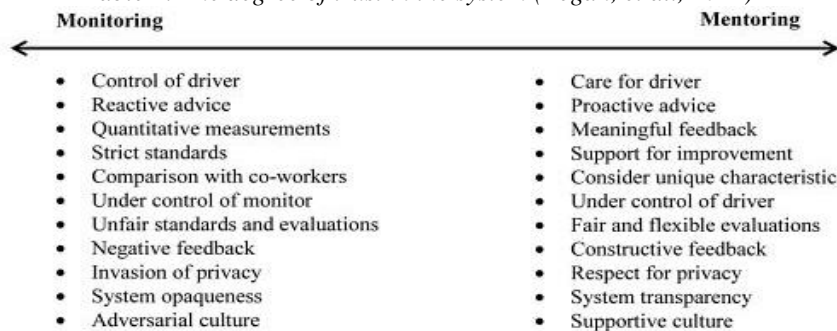
(Zwick,2000), implied that innovations are brought about to improve service availability, increase productivity, improve performance of employees, and client friendliness, flexibility and satisfaction. Passengers or public transportation users could have positive perceptions towards developments in technology if these technologies would improve service delivery and customer satisfaction, operators would have more interest in innovations that increase productivity, performance of employees, i.e. drivers. These goals somehow put pressure on the driver, as the facilitator between the operator and the passenger to deliver the transportation service in a way that customers will be satisfied and the operator’s business.

Table 1: The responsibility of drivers and operators in service provision (Rohani, Wijeyesekera & Karim, 2013)

Items in Quality of service	Bus provider	Bus driver
Reliability	X	X
Responsive	X	X
Competence	X	X
Access	X	
Courtesy		X
Communication		X
Credibility	X	X
Security	X	X
Understanding / knowing the Passenger	X	X
Tangibles	X	

Table 1 shows the responsibility of drivers and operators in service provision as the driver also have responsibilities towards the passengers. (Rohani, Wijeyesekera & Karim, 2013) stressed the point that it is vital for drivers to have good communications with bus passengers and to be service oriented. Drivers in public transportation are in their working environment, therefore the ICT solutions improving the public transportation system should improve their working conditions. (Fourie,2003) listed bad working conditions, lack of skills and appropriate training, as some of the common problems in the public transportation industry.

Table 2: The degree of trust in the system (Regan, et al., 2014)



As ICTs can be used by operators or governments to monitor drivers, they can be used to both monitor and mentor drivers, that way out the negative impacts of monitoring such as invasion of privacy and compromising driver behaviour shall be balanced by mentoring. Noting that most operators have shown interest in tracking and monitoring technologies like CCTVs, tracking devices and speed monitoring devices. Operators aims of managing their enterprises through ICT can influence the attitudes can go beyond perceptions of transparency, privacy and fairness to determine the degree of trust in the system (Regan, Horberry & Stevens, 2014).

With the current public transportation system, there is uncertainty these important attributes of the system, safety, accessibility. Uncertainty implies that the decision maker, the passenger or public transportation user does not have the perfect information (Ben-Elia & Avineri, 2015). Information availability and accessibility therefore provide certainty and assurance to the passengers. With journey planning and instant notifications there is an illusion of assurance, passengers can know the time vehicles arrive, departure time and in cases of delays and breakdowns, they can be assured of the next vehicle’s arrival time or the exact time the vehicle is delayed by. Passengers avoid public transportation due to safety concerns. Monitoring and tracking technologies perceives safety and also deters crimes such as robberies in public transportation stations, vehicles and waiting areas. Passengers and drivers, unlike operators have relatively similar perceptions on what needs improvement in the public transportation system.

The quality of service provided by the operators determines the customer satisfaction, while the quality of service and driver behaviour also determines customer satisfaction. Driver

behaviour is also influenced by operators' behaviour. Therefore, in order to satisfy all the stakeholders, their needs must be aligned/ synchronised.

## METHODOLOGY

Quantitative data collection via questionnaires was undertaken by employing stratified random sampling method to gather information from public transportation users, drivers and vehicle owners / operators. Owners of mini bus taxis and buses operating in the Free State province were asked about the technologies they would like to have in future, if conditions permitted, use in their vehicles. Passengers were also asked about the technologies they are willing to use. The study was carried out in the Free State province between June and August 2015. The questionnaires were given to operators at the Department of Police, Roads and Transportation licencing office where public transportation vehicle owners gather daily. Other questionnaires to passengers and drivers were administered at taxi ranks and Hoffman square where passengers wait for buses and drivers park their vehicles while waiting to leave at their scheduled times.

## FINDINGS AND DISCUSSIONS

### Passengers and drivers

Figure 2 shows the technologies which passengers and drivers are willing to use. The study looked at the technologies people are willing to use, therefore reflecting on what they think it's useful or will be easy to use. 38% of the respondents indicated that they will be willing to use tracking devices, while 20% indicated that they will be willing to use CCTV cameras. These technologies can be classified as monitoring technologies, which ensures secure and safer working conditions for drivers and perception of safety to the passengers. 25% and 22% of respondents indicated that they will be willing to use map and route display screens and buzzers respectively. Buzzers are a necessity as they will convey the message about a passenger willing to debus to the drivers and are also very easy to use. They will safely send the message to the driver without destructions as currently the passenger has to walk over to the driver and tell him to stop or shout the message across the vehicle to the driver.

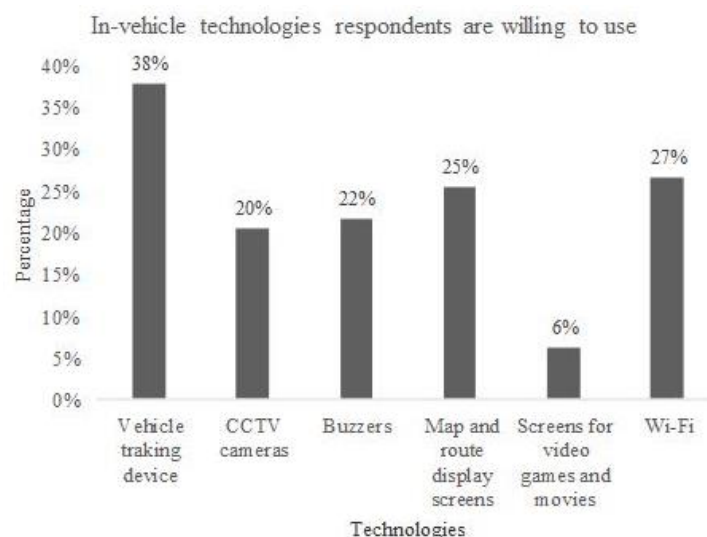


Figure 2: In-vehicle technologies respondents are willing to use

The usefulness of map and route display screens is indicated by the fact that information availability provides assurance and certainty to passengers. Drivers and users indicated that introducing screens for entertainment purposes (TV, gaming) is not a much needed technology as only 6% was willing to use them, these technologies may be easy to use but not

entirely useful as they do not promote accessibility or safety. Reliable internet availability plays a major role in real time information provision and accessibility, for some ICT application to fully function there should be connectivity. 27% of drivers and users indicated that they will be willing to use Wi-Fi if it is provided in the public transportation system. Wi-Fi can be provided at bus stations, bus stops and inside the vehicles for internet surfing, working and social networking. Public transportation users can use it to access the internet while waiting to board vehicles or during trips, as this will also create the illusion of time moving faster when they are kept busy.

**Operators**

44% of the operators indicated that they are willing to install buzzers in their vehicles for passengers to be able to notify the driver to stop. Buzzers are a way of sending information to the driver without distracting him, that making them useful and are easy to use as they do not require any skill to operate. 34%, 40% and 28% of operators indicated that they were willing to install tracking and monitoring technologies i.e. vehicle tracking devices, Speed monitors and CCTV cameras. Monitoring technologies however raises questions to whether the operator is ensuring customer safety or protecting their investments by monitoring drivers. Many operators would like to add vehicle tracking technologies to their vehicles, in order to monitor the movement of their vehicles and how drivers use the vehicles. As owners of vehicles, operators tend to be more concerned about the safety of their vehicles instead of satisfying the needs of the customers. Monitoring speeds is a way of ensuring the wise use of their vehicles by the drivers. Monitoring drive behaviour through CCTV, this may compromise the freedom of drivers as being under scrutiny all the time may make them uncomfortable.

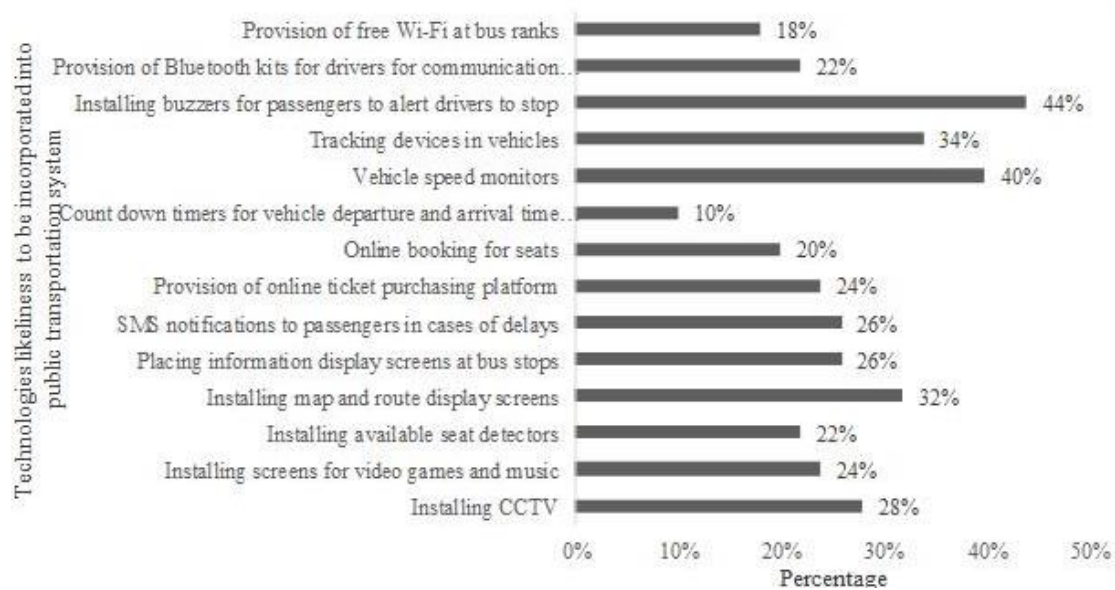


Figure 3: Information Communication Technologies the public transportation operators are willing to provide in future

26%, 26% and 32% of respondents indicated that they would provide SMS notifications to users install information display screens and map and rout display screens respectively. Information may be of fundamental importance to the users, but does it carry the same weight of importance to operators? Only 10% of operators were willing to install countdown timers to provide real time information on status or location of vehicles at bus stations or stops. This indicates that provision of information to passengers may not be a priority to them. Referring to the TAM, these technologies are useful and easy to use, but do not seem important to the operators. 24% of operators indicated that they were willing to provide technologies for

entertainment, by providing screens for TV and gaming, this compared to the passenger and driver's needs.

### Drivers, Passengers and Operators

The figure below shows challenges likely to be faced by all stakeholders if ICTs are to be integrated into the public transportation system. These are the factors the drivers, users and operators will hinder the integration process and therefore should be addressed.

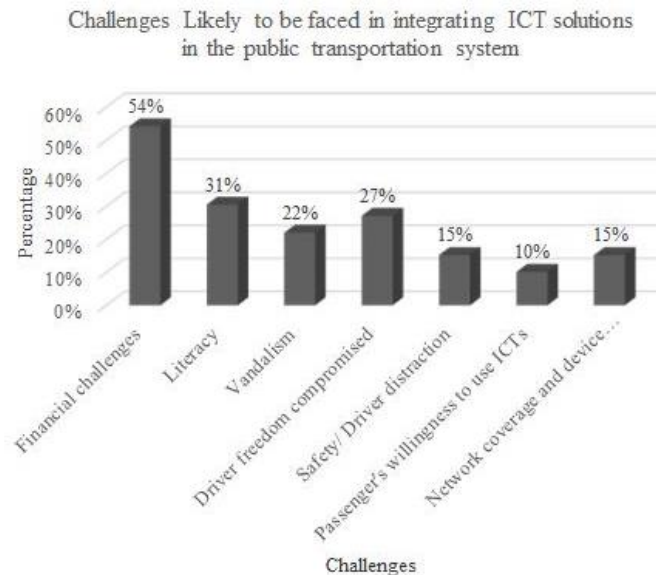


Figure 4: Challenges Likely to be faced in integrating ICT solutions in the public transportation system

**Financial challenges:** 54% of the respondents cited financial challenges: Installation of electronics and applications will result in financial implications for the operators, and some operators may not be able to install them at all. The passenger's take on financial implications will be the prices of internet connectivity, mobile data for downloading public transportation applications. There is a perception that improved public transportation services will result in increased transportation fare amongst public transportation users. This indicates that people in the Free State think that ICTs are likely to be not affordable.

**Literacy:** 31% of indicated literacy as a possible problem. This relates to ease of use of technology in a sense that, one should have a certain literacy level to be able to use some applications and technologies and be able to read.

**Driver freedom is compromised:** With tracking and monitoring technologies, drivers will no longer be free to use vehicles for their personal errands. 27% of respondents indicated that drivers' freedom will be compromised; their privacy will be invaded if they were to be monitored all the time.

**Vandalism:** 22% of the respondents indicated that vandalism of electronics and applications by users and drivers is also a possible course for concern. ICTs installed in vehicles and bus waiting areas may be deliberately destroyed. With security or monitoring technologies in place, there should be able to monitor any unlawful tampering with the installed applications.

15%, 10% and 15% of respondents respectively indicated that driver distraction, passengers' willingness to use ICTs and network coverage could also be possible challenges. Some technologies especially for entertainment purposes may distract the driver and cause accidents and damage to vehicles. If ICTs are introduced to the public, the people whose travelling experience they are meant to improve, the people should be willing to use them in order for the integration to be successful. Rural areas in the province have connectivity problems and

this may affect the use of mobile applications, web-based platforms such as trip planning and social networking sites.

## CONCLUSION AND RECOMMENDATIONS

The paper investigated the perceptions of Free State public transportation stakeholders towards using Information Communication Technologies in the system. The perceptions of the stakeholders' lean towards their involvement with the public transportation system. We need to remember that the main aim of public transportation service is to provide safe, reliable, affordable and accessible transportation. Within these lies factors such as comfort, certainty and freedom for all the stakeholders. The results the stakeholders have conflicting expectations from integrating ICT solutions into the public transportation system. The ICT solutions for a safer public transportation for instance are not perceived similarly by the stakeholders, they may be safety assuring measures to operators and passengers but not comfortable for drivers.

Drivers and operators should use their responsibilities towards passengers to surpass their personal needs and expectations from ICTs. Their responsibility is firstly to serve the passengers. Considering this, drivers should settle into the idea that monitoring technologies are for the safety of all stakeholders and operators should not abuse the monitoring technologies to make the working environment uncomfortable for the drivers.

Perceptions can also be a result of usefulness and usability of technologies as they are driving forces towards acceptance of technologies. Stakeholders are not willing to accept technologies they do not see useful or they will not be able to use. This should, for implementation in future, prompt decision makers to deploy useful and usable technologies in the transportation system.

Integrating ICT solutions into the public transportation system will have financial impacts on operators and passengers. Operators should provide these technologies in their service provision (installation, maintenance, and operation) while passengers need finances to access and use some technologies, e.g. smartphones, data / airtime. The passengers, taking into consideration the prices of the current transportation services think that improving the system for the better will also result in increased service fees. Generally, the perceptions are influenced by the current state of the system, user acceptance, based on perceived usefulness and ease of use of the technologies as well as the anticipated behaviour of stakeholders towards the technological innovations.

This paper provides more insight and understanding into stakeholders' perceptions to help in decision making concerning introducing new technologies and innovation in the public transportation system. It will therefore improve the decision making process and also help other stakeholders participate in the process and their perspective be taken into consideration.

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