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ICT Usage to Improve Efficiency in the City of Johannesburg Public Transportation System

Siphiwe Given Mbatha, Trynos Gumbo, Ouwayeni Oniya, Thembani Moyo

(Siphiwe Given Mbatha, Dept. of Town and Regional Planning, University of Johannesburg. Cnr Siemert & Beit Streets, Doornfontein 0184 Johannesburg, South Africa, gmbatha@uj.ac.za)
(Prof Trynos Gumbo, Dept. of Town and Regional Planning, University of Johannesburg. Cnr Siemert & Beit Streets, Doornfontein 0184 Johannesburg, South Africa, tgumbo@uj.ac.za)
(Ouwayeni Oniya, Dept. of Town and Regional Planning, University of Johannesburg. Cnr Siemert & Beit Streets, Doornfontein 0184 Johannesburg, South Africa, oboniya@uj.ac..za)
(Thembani Moyo, Dept of Urban and Regional Planning, University of Johannesburg. Cnr Siemert & Beit Streets, Doornfontein 0184 Johannesburg, South Africa- thembanijoel@gmail.com)

1 ABSTRACT

Information communication simplifies the way of living as everyone is updated with everything happening around them. With technology, information distribution becomes more efficient and convenient, and everyone could have access to the same information which on most occasions is accurate. Globally, developed countries have implemented different techniques in information dissemination for public transport through technology which today these technologies are adopted in public transport everywhere in the world including developing countries. South Africa is a developing country that has numureous public transportation systems for commuting and with the City of Johannesburg (COJ) having all forms of public transportation available in the country. Currently, the city has various forms of public transport including both formal and informal public transportation such as ride-share services (uber and taxify), Bus Rapid Transit system (BRT) known as Rea Vaya, High-Speed Trains (HST) known as Gautrain system and traditional public transport systems (mini-bus taxis, Putco Bus, metro rail). This paper seeks to identify whether the high usage of ICT could assist to integrate both formal and informal public transport systems through different dynamics to deliver sustainable and convinience public transportation systems. The study adopted a case study research design and a mixed method approach that facilitated the gathering and analysis of both quantitative and qualitative data from the public transport officials and commuters. Statistical, content and document analysis were used to glean more information. Preliminary results indicated that Innovative formal public transportation such as Gautrain system, Rea Vaya bus, uber and taxify deployed the usage of ICT which makes commuters to be informed with the whereabouts of the innovative public transportation, however, commuters still struggle with convinient movement in and around the city due to numerous factors. Consequently, informal public transport such as mini-buses (taxis) which transport 60% of commuters daily in and around the city does not have the usage of ICT in any form but can be efficient at certain times and can also be frastruating at some times as there is no form of communication. The implications of the study indicate that the city has the high availability of public transportation which is disjoint from each other affecting reliabilty and efficiency for commuting as there is lack of formal information communication within these different public transportation systems as all of them are interested in benefiting individually. The study recommends a development of an integrated online application which will provide information on both formal and informal public transpotation plartforms in the City of Johannesburg for commuters to be able to be informed of the availability of public transport in the City for Johannesburg 24hours for conviniency. Further, this app could assist commuters to identify the movement of the innovative formal public transport in-real time to create seamless travelling if necessary, for commuters. With efficient and integrated public transport system in the city will result in more usage of public transportation.

Keywords: ICT, formal public transport, informal public transport, integration

2 INTRODUCTION

Contemporary public transportation systems are tailored towards improvement of mobility. Mobility infrastructural developments continue to be a necessity across all epochs of life, in light of this and the emergence of the fourth industrial revolution era, cities are investing on new innovative systems to improve connectivity. Within the South African context, the City of Johannesburg Metropolitan Municipality has implemented various innovative transportation systems. Currently the city has various forms of both formal and informal public transports such as ride-share services (uber and taxify), bus rapid systems (Rea Vaya) and high-speed trains (Gautrain), traditional public transport systems (mini-bus taxis, Putco Bus, metro rail).

To ensure synergies are shared between traditional public transportation and innovative public transport systems, the use of technology and big data which are now available and can be mined due to the emergence of the fourth industrial revolution are proposed. The objective of this paper is to identify a strategy to integrate the existing formal public transport with the informal public transport within the City of Johannesburg. As various modes of public transports serve a different purpose to different communities. The paper identifies the mostly used public transportation modes and assess the different information dissemination of the existing public transport. The integration of public transport will not only make trips faster but also safer since stations will be in close proximities and commuters do not have to travel long distances to catch another mode of transport.

3 LITERATURE REVIEW

3.1 Urban public Transportation

Cities and metropolitan areas are centres of diverse activities, which require efficient and convenient transportation of persons and goods. It is often said that transportation is the lifeblood of cities. Vuchic (2017) states that high density of activities makes it possible and necessary that high capacity modes, such as bus, light rail and metro, be used because they are more economical, more energy efficient and require much less space than private cars. Moreover, public modes of transportation provide service for all persons, while cars can only be used by those who own and can drive them (Nur & Gammons, 2019). Thus, cities need and benefit from public transportation services, which offer greater mobility for the entire population than people in rural areas can enjoy. Transit systems are also needed in urbanized areas to make high-density of diverse activities, such as residences, business offices, factories, stadia, and other activities physically possible, while keeping cities liveable and attractive for people (Vuchic, 2017). Urban Public Transportation is defined as a form of travel offered locally that enables more people to travel together along designated routes (Vassilis, et al., 2019). Typical examples of forms of public transportation include buses, trains, and in other countries trams, high-speed rails, airlines, and coaches dominate public transportation between cities. Most public transport services operate on stipulated timelines. Some transportation systems operate on a full capacity basis, which means the vehicle will not start until it's full. However, many cities across the world provide shared taxis when the essence of time is a factor (Viergutz & Brinkman, 2018).

Urban Public Transport is a system that is used to serve all individuals moving from origin to destination and a certain fare should be paid for a trip taken (Lyons, 2019). Public Transport offers different kinds of service including the operation of a certain system depending on the service providers. Mostly, each and every system has start and end time, some operate 24hrs for example mini-bus taxis and ubers/taxify in South Africa, during the week and weekends operations are different, and these systems have certain intervals of operation(Zhong-Ren et al., 2012).

3.1.1 Bus rapid transit (BRT) system

When buses are physically separated, through some investment, from cars, this has become to be known as a Bus Rapid Transit (BRT) system. Basso et al., (2019) define the Bus Rapid Transit as a system with high-quality bus-based transit system that delivers fast, comfortable, and cost-effective services at metro-level capacities. It does this through the provision of dedicated lanes, with busways and iconic stations typically aligned to the center of the road, off-board fare collection, and fast and frequent operations" (Walters, 2013). Due to the BRT containing features similar to a light rail or metro system, it is much more reliable, convenient and faster than regular bus services. With the right features, BRT can avoid the causes of delay that typically slow regular bus services, like being stuck in traffic and queuing to pay on board (Basso, et al. 2019).

Buses represent the most widely used transit technology. Virtually every city in the world that has transit service operates buses. Large cities with rail transit also operate extensive bus networks, usually on lines with lower passenger volumes or as feeders to rail lines (Basso, Feres, & Silva, 2019). The BRT service is easy to introduce or modify, basic service requires only purchase of vehicles, garage and maintenance facilities, and organization of service. Stops along the lines can be simple (Ordóñez Medina & Erath, 2013). Therefore, buses represent the most economical transit mode for lightly travelled lines. This flexibility of bus routes is an advantage for any necessary changes, but it is a disadvantage for major bus lines: they lack

permanence, efficiency in carrying heavy passenger volumes, and image of permanent, physically fixed routes desired by passengers(Basso et al., 2019).

Earlier, the public transport industry structure typically was of two types, the publicly owned monolithic companies that operated the entire system as in Paris, New York, or Moscow, or a collection of small private operators like in Lagos, Nairobi, and Bogota (Viergutz & Brinkman, 2018). However, the emerging industry structure is the one where a public entity determines the routes and schedules and contracts operations from private operators. This practice has become common in London (for its bus services), Bogota (for its BRT system), and a host of other cities. Such an arrangement allows the public sector to ensure that good public transport is available to all citizens and, at the same time, allows private sector efficiencies to be tapped for operations (Viergutz & Brinkman, 2018). However, such a contractual arrangement would not have been possible if technology had not permitted a detailed tracking of vehicles(Walters, 2013). The ability to track vehicles has made it possible to easily enter into fleet operating contracts as it is possible to monitor the implementation of the contract more effectively. Thus, it is possible to verify whether buses completed the entire journey, whether they were on time, and a host of other metrics (Luke & Heyns, 2020). This allows for contractors to be paid based on actual performance and also facilitates rewards and penalties for over- and underperformance. The BRT system is made possible through the implementation of ICT.

3.1.2 Uber and taxify

Uber is an application that connects passengers with drivers who have a contract with Uber (Contents, 2019; Coppola & Silvestri, 2019). To order a vehicle it is necessary to own a smartphone and to register within the mobile application by entering your name, e-mail address, a cell phone number and a credit card number that is to be billed automatically at the end of the ride. According to Pojani and Stead (2015), among the biggest disruptions in the current transport system has been the arrival of aggregator platforms that have allowed car sharing systems like Uber, Lyft, Didi, and Ola to emerge. Essentially, such platforms match the demand for trips to the supply of trips(Hensher, 1998). Passengers book for rides to travel from a certain point to another and the platform locates available taxis, or other vehicles that are available, and match the two. This has proved immensely convenient to both passengers and to taxi operators and is, therefore, disrupting the market. All this is possible through the employment of Information and Communication Technology. This was launched early in April 2016, the Delhi-based start-up provides people with an opportunity to share rides with others while also helping them reach their destinations faster and in a more cost-effective manner by reducing the waiting period for a cab or an auto by connecting a network of people who are driving on the same route (Basso et al., 2019). The app plugs the demand and supply gap between drivers and riders by allowing a person with seats to spare, be it in a car, an auto, or even a cab, to share his or her route online and connect with a person heading the same way using various route matching algorithms(Coppola & Silvestri, 2019).

Passengers can request a ride and if accepted by the pooler, it will direct them to the “pikup” point determined by the app. Once the ride is complete, a cashless payment process is initiated through card-less banking payments, further making the process less cumbersome by avoiding the hassle of change(Coppola & Silvestri, 2019). The entire operation is simple and allows a convenient way of traveling. The prices are also transparent and listed on the app in the form of rate cards that are fixed based on the distance covered. Walter (2013), alludes the entire process of uber makes it less expensive and auto rates since it is immune from surge pricing and other time-based charges. The app also allows a female-only option that matches female riders with seekers. There is also an SOS feature, where apart from a person’s registered contacts, Pikup will also receive a real-time update on a user's whereabouts through SMS and call (Basso, et al. 2019).

3.1.3 Minibus taxis

The minibus taxi industry which is mainly operated using 16-seater minibus taxis is responsible for providing public transport services to a significant number of commuters (Baloyi, 2013). This is due to network flexibility that this mode of transportation mode offers, it is more accessible than trains (rail transport) and, therefore, more intensely used. It is also much faster than the bus services as it does not operate on a fixed schedule (Binza & Siyongwana, 2012). Though the minibus taxi industry offers better services mentioned above the industry is not subsided by the government. Baloyi (2013) notes that the minibus taxi industry plays an important role in both rural and urban public transportation systems, both in mobility and economic terms. The industry employs a large number of people and circulates significant large

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amounts of money. Although the way the taxi industry is organized varies across countries and even within countries, some factors are shared at varying latitudes of the globe.

The biggest challenge with the integration of all public transportation is the resistance by taxi owners, operators and drivers (Machiavelli, 2019). These role-players are prepared to sabotage any development that that is meant to improve travel conditions for the general public. Just like every other capitalist, taxi owners are concerned with the generation of profit more than the improvement of the mobility systems. In that case, a system that will ensure profit for taxi owners and decrease in the usage of public transport needs to be put in place.

3.2 Information and dissemination

Information Dissemination is defined by Gkania and Dimitriou (2019) as an active distribution and the spreading of information of all kinds to the users or those audiences that deserve it. In developing effective dissemination strategies, plans and policies for public transport companies there is a need to understand the scope and characteristics of their current and potential users. Appropriate dissemination is a significant aspect in attaining user satisfaction and increasing usage(Koutsopoulos, Ma, Noursalehi, & Zhu, 2019). According to Pojani (2015), in the dissemination and utilisation processes five fundamental processes need to be analysed namely:

(1) User: the potential user of the product to be disseminated (NCDDR, 1996). The user is the receiver of information which can only be considered effective if the user is able to successfully utilise the information received to maximum satisfaction.

(2) Source: the agency, organisation or individual responsible for creating new knowledge or a product for conducting dissemination activities.

(3) Content: the knowledge of the product itself; an example in public transport content consists of travel times, routes, fares and timetables (NCDDR, 1996).

(4) Medium: ways in which knowledge is shared or the product described and packaged or transmitted, for example, SMS's, e-mails, mobile apps, public information displays and social media.

(5) Context: the way the product or knowledge is developed and disseminated, including contextual factors related to the source, the user, the content and dissemination medium (NCDDR, 1996).

There are typically great reasons why associations choose to disseminate information, they are normally related but can be categorised to underline the motivation and significance of effective information dissemination.

According to the NCDDR the following categories are reasons for information dissemination:

(a) Judgement: Information is disseminated with the expectation that individuals within an organisation will improve their knowledge and subsequently improve their judgements in future situations.

(b) Awareness: Information is disseminated with a specific end goal to teach, clarify and advance an idea, procedure or standard. For instance, technical stipulations explaining systems, capabilities, instruction about alternative transport to avoid congested routes, notification of train delays, are all ways in which information is disseminated (NCDDR, 1996).

(c) Response: information is often disseminated with the sole expectation that it will bring about some feedback that may require additional data to be created. Examples include advertising, questionnaires, market survey, etc.

(d) Collaboration: Information is regularly disseminated in order to share knowledge and ways of communication. Examples incorporate workflow systems to encourage the flow of information between systems in order to accomplish a common purpose, e.g. control systems where probes may identify and transmit notices about specific events (NCDDR, 1996).

3.3 Information and Communication Technologies ICT

There is no single universal definition of Information and Communication Technology (ICT), the term is generally accepted to mean all devices, networking components, applications and systems that combined allow people and organizations (i.e., businesses, nonprofit agencies, governments and criminal enterprises) to

interact in the digital world (Agarwal et al., 2018; Azolin et al., 2020; Litescu et al., 2015). ICT applications aim to provide information through innovative services relating to different modes of transport and traffic management that enable various users to be better informed and make safer, more coordinated and smarter use of transport networks. The use of ICT guides and inform commuters how a certain public transport system works, and this information is provided in a portable manner.

The use of ICT in urban public transportation helps in allowing data to be compiled on the speed of vehicles in different parts of the city, or different sections of the road network, the time taken to move from place to place, the distance travelled, the points at which the vehicle stops and for how long and other important information for commuters (Litescu et al., 2015). This helps in getting an idea of the level of congestion at different points of time in the day and the choke points in the city that need attention. This also helps in planning routes and schedules on a more scientific basis. It also helps in monitoring driver and vehicle behaviour for corrective action. It provides information on the exact time at which a vehicle reached a certain place and the route it followed in moving from place to place. This allows contracts to be monitored and a verification of whether contracts terms have been met.

3.3.1 Social Media

In the 21st century, the use of Information and Communication Technology has revolutionised and subjects such as social media has transformed the way people interact and share information in essence the way individuals communicate. According to WeAreSocial (2020), there are 3.8 billion social media uses in the year 2020, these statistics might have increased during the Global corona virus lockdown across the world.

Social media platforms are defined as web-based services that enable people to disseminate and receive information in real time (Gal-Tzura et al., 2014). Social Media may be used for various functions such as promoting businesses, for customer relations and for real time information notices. For this reason, the use of social media grows day by day and various sectors have begun to take social media marketing seriously as they are able to reach a wider audience through this medium (Musakwa, 2014). Social media is utilised by individuals of different ages, nationality employment status and with diverse interests. The social media community comprises a rich sample of members which allows these platforms to be powerful tools that are suitable for collection of transport data, by surveys or other ways (Gal-Tzura et al., 2014). Social media can be seen as a tool that is used for transport related applications and transport companies use this platform to communicate with their users (Amey et al., 2011; Bregman, 2011; Gal-Tzura et al., 2014). The core purposes of social media use across organisations are information sharing and updates, advising the public on travel disruption, handling travel queries, and responding to queries and messages. The information posted by organisations includes updates on travel delays, marketing and promotion deals which is done to expand brands and to have direct interactions with users (GalTzura et al., 2014).

Transport companies also use marketing concepts such as “seasonal goodwill messages” sent to commuters and was seen on many of the sites. This was consistently informal in nature and seemed to be aimed at promoting the concept of timeliness, community and friendly service (Litescu et al., 2015). The magnitude of the organisation overall does not influence its use of social media. Large organisations do not necessarily use social media as a strategic tool. The transport sector and commercial sales sector will not utilise social media in the same way, each sector uses social media in various ways and one more than the other. According to Gal-Tzura et al. (2014) “the longer the social media sites have been established, the more likely the use becomes focused”. A trend for interaction was noted with some associations that use social media in a highly interactive way setting an example for other organisations (Litescu et al., 2015).

3.3.2 Mobile transport Application

While gaining knowledge about the main part of public transport trip might have been historically possible, information on the critical secondary connections was not. This was particularly the case in developing cities with limited, if any, formal, fixed route and schedule bus systems covering only a small part of the entire conurbation with service (Coppola & Silvestri, 2019). Today’s ICTs provide the ability to map the entire formal and informal public transport systems, providing passengers with a complete picture of travel options, from actual origins to actual destinations. That information can be made available anywhere, at home or work, at stops, stations and terminals, and even on-board. People need travel information for their trips from their origins to their destinations. It also helps reduce uncertainty for people making new trips. Public

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transport systems typically focus on providing service information to the public. This information covers routing and stops, schedules, and fare payment.

Information Technology has developed over the years with internet connectivity and mobile devices presenting an opportunity to tackle private mobility (Speed and Shingleton, 2012; Dickinson et al., 2015). The availability of smartphones allows users to access travel information about their travel issues, to view where others might be in their social network and share information (Dickinson et al., 2015). Application developers have recognised this potential and as result there have been great developments in a range of apps that track users, share travel information and provide real time public transport information as they enable access to data resources that were once perhaps difficult to access (Litescu et al., 2015). Smartphones are the ideal travel instruments as they can be used on the move and to share and, access information on travelling (Dickinson et al., 2014). The trends of applications have been focused more on travel information and route planning. However, more recently transport companies have developed apps to facilitate a more collaborative use where commuters may purchase tickets in advance through these mobile apps and use their smartphones as tickets (Koutsopoulos et al., 2019). These apps assist users to join social networks and to make better use of their collective travel resources, thus potentially allowing users to be interactive on social media. Analysis of the collaborative travel apps currently available indicates that they operate according to various forms of exchange, each social app serving its purpose. Travel apps are unlikely to play a role in these settings through person to person connectivity of smartphones which makes them a useful facilitating tool (Dickinson et al., 2015).

3.3.3 Real time information dissemination

ICT has made it possible to locate a vehicle and also track its movement from a central control station. This has been possible due to a global positioning system (GPS) device being fixed to a motor vehicle and programmed to continuously communicate its location to a central control centre (Machiavelli, 2018). This information can simultaneously be communicated through specially developed apps to individual mobile phones. Similarly, GPS embedded on most smartphones allow the location of a person using that phone to be communicated to a central control centre, thereby allowing an assessment of the level of crowding in any area. The ability to accurately track a motor vehicle has led to many possibilities that were not otherwise feasible (Vuchic, 2017).

3.3.4 Public information Display

Public Information Display systems are defined by Vuchic (2017) as an automated system for supplying users of public transport with information about the nature and state of a public transport service, through visual, voice or other media. Public Information Displays are becoming very common in modern public transportation. Realtime information displays are prominent in the transportation sector. These systems show real- time information by providing features such as next departure of trains and buses at stations and stops (Machiavelli, 2018). Research has shown that this kind of information is appreciated by commuters and the installation of PIDs is to improve significantly traveller information and the quality of service. In evaluating PIDs, commuters often question their reliability and comprehensiveness (Dziekan and Kottenhof, 2007).

4 STUDY AREA

The City of Johannesburg is the focus area of study. The city is home to 7 regions and is the largest city in the country and contributor to the country's GDP. The City of Johannesburg is the biggest contributor to South Africa's economic growth and is also the most polluted city in the country as of the 2011 population survey (Stats SA, 2012). The city was founded prior to the discovery of gold which led to high employment of the South African populace through gold mines (Rand Refinery, 2013). The city is home to numerous townships, one of which is Soweto, the oldest and big township in the country.

The establishment of the gold mines in the area led to the flooding of South Africans from different provinces into the City of Johannesburg for "greener" pastures. This extended to neighbouring countries where people came into the city for mostly unskilled labour (Rogerson & Rogerson,2014). This led to a need for more public transportation, improved transport infrastructure in the city such as roads and railways which led to the improvement of public transportation, specifically the railway systems.

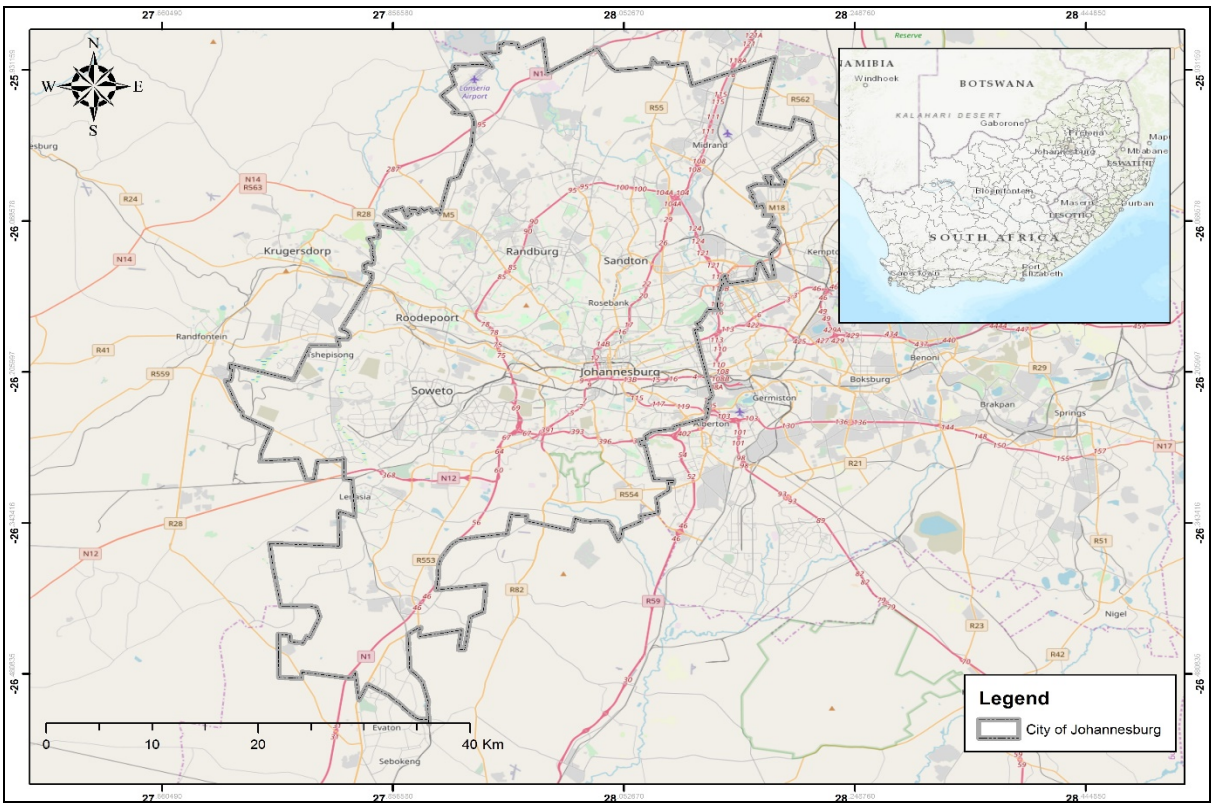

Figure 1: Study Area. Source: Author, 2021

5 METHODOLOGY

A mixed method research design was adopted where qualitative data and quantitative data analysis was used. Various research instruments were employed in the study. Five interviews were carried out with officials from different departments, including the Department of Transport and Metropolitan Municipalities transport planners whom assisted in providing insights for the study about the possibility of integrating the different public transport modes of formal and informal public transport in general, and how to integrate the different entities of UPTs in the city. Accordingly, commuters were also interviewed to understand how commuting is with and without information dissemination. 10 different daily commuters were interviewed who may have different experiences taking place daily. Purposive sampling was adopted as it was necessary to conduct interviews with informed officials and commuters. Interviews, observations and documented studies relating to this study were the sources of data. Further, content analysis was employed to review previous documented studies and used to for strategies to explain the methods of integrating both formal and informal public transportation. Secondary information used was obtained from larger data base such as Scopus, Science direct, Sage and Google scholar.

6 RESULTS AND ANLYSIS

6.1 Bus Rapid Transit System (Rea Vaya)

This mode of transport uses various forms of information dissemination for commuters which include plartform timetabling, online fixed timetables and public information display system in the stations and inside the bus.

The above figure shows a public information display system, these systems are not working in many Rea Vaya station. There are no clear indications on when the bus will be arriving at the stop and when it will depart from that station. Passenger of the Rea Vaya Transit complain that there is no specific time for travelling and buses stop and leave whenever. This is frustrating for workers who made 51% of the study group, this is because they are sometimes late for work due to the inconsistencies of the travel time. Consequently, on the stations where this system work's, the bus that does not arrive at the stipulated times.

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Figure 2: Rea Vaya PID's [Source: Author, 2021]

6.2 Gautrain system

This mode of public transportation has trains and a buses, and it has most improved information dissemination in the city of Johannesburg as stipulated by commuters. There is availability of a mobile app that provide the operations of the Gautrain including the departure and arrival times, the movement of the train in real-time, how one can switch inbetween from Gaubus to Gautrain with reasonable time intervals allowing commuters for switch inbetweens. The stations have the PID's in the station and inside the trains that functions very well.

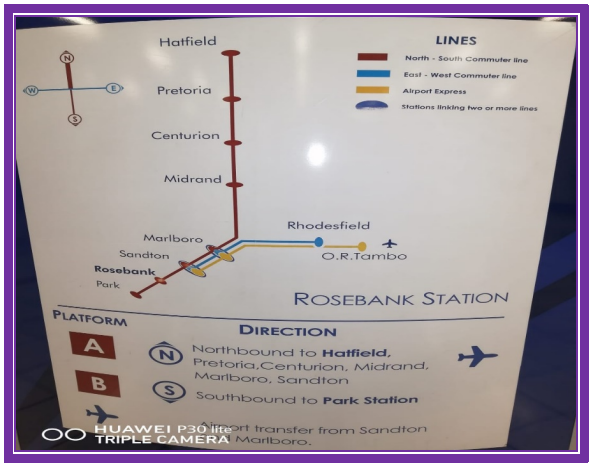

Figure 3: Gautrain map [Source: Author, 2021]

The above figure shows the Gautrain railways. These maps are placed at the entrance of everything station so that commuters know how the trains moves and how the stations are following each other. This also shows the directions of the railways, so that people who are going to the ORTIA can know where to get off and how they can change trains. Only 29% of the commuters were aware of this map, other commuters said they rely on the PIDs inside the trains that show which stop is next.

6.3 Public information display

In an age of mass public digital communication, large screen displays are emerging everywhere, particularly in well trafficked public places such as train stations, airports, hotels and shopping malls. These public displays have been receiving considerable attention as highly effective and visually compelling communications platforms, delivering information and related advertising (Lee, 2016). The figure below shows an example of a PID system and the information that is normally displayed for passengers.

Figure 4: PIDs [Source: Author 2021]

The survey revealed that 73,3% were aware of PIDs while 26,7% were not. It indicates that most respondents are aware that there are Public information Displays. Public Information Displays (PIDs) provide new possibilities for transportation companies to provide information at different stages of the journey. Public displays with interactive functionality provide the opportunity to support different users in their interaction, through specific support functions by providing information on schedule, calculate fares and train and bus routes. Gautrain has public information kiosk that offer users with the type of information they would need for their trip. These PIDs provide real-time and punctual information to commuters and 94% of the commuters were happy with these systems and the accuracy of the information.

6.4 Uber and taxify

This mode of transportation is convinient and reliable. It takes a certain number of people, it can be one to four if its a normal car, and if passengers are more than that they can be able to request for a large car that will be suitable for a group. It is expensive if is used by one individual compared to local minibus taxis and lesser if its used by a group as the prices are fixed based on the trip distance.

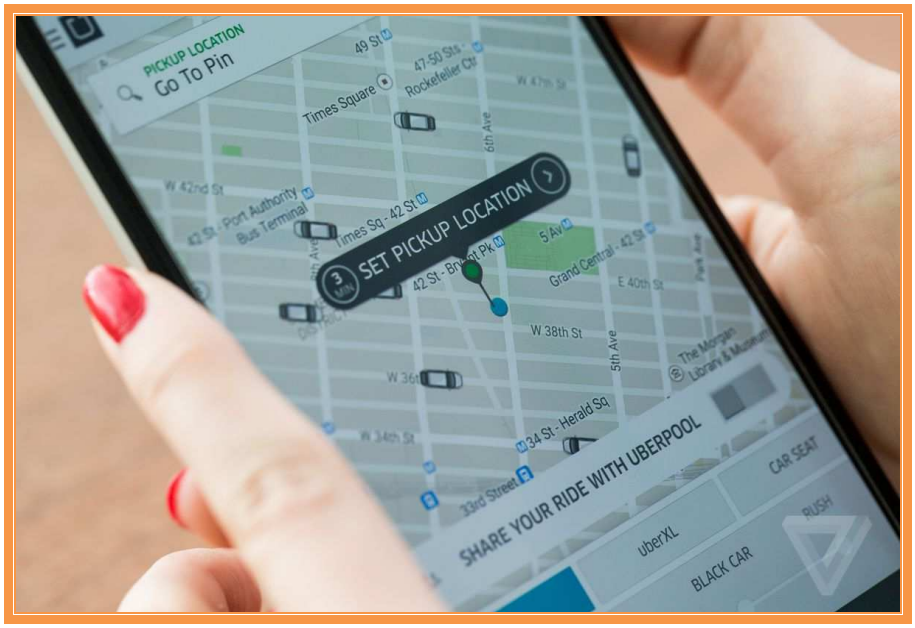

Figure 5: Uber App [Source: Author, 2021]

The above figure 5 indicates the application that is used for a uber/taxify for one to be able to request or use this mode of public transport. Many commuters deem this mode of public transport to be reliable as picks an individual at any convinient place from orig to destination without any unneccessary stops made. Commuters when requesting a ride can be able to see where the mode of transport is and the wait mostly is not more than

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five minutes if its a long time to wait. Further, the payment methods are done both electronically through the app and cash payment at the end of the journey.

5.5 Minibus Taxis

The operation of minibus taxis in the city of Johannesburg does not use any kind of technology to operate. Commuters commute in the designated taxi ranks (stations) and along the streets for conviniences. Areas differ from one location to the next depending on how the area is busy. The busy the area no more minibuses taxis are available and commuting is easy. In the locations that are not busy, it is hard for commuters to get minibus taxis.

Figure 6: Bree Taxi Rank [Source: Author, 2021]

The above figure indicates the one of the Johanessburg taxi ranks (minibus taxi station) where coummuters take the minibus taxis from origin to destination. Mostly, formal taxi ranks are designed in such manner and the only information that is provided are boards indicating where taxis travel to. There is no timetabling provided for commuters to know the times of taxis depature, on some occassions taxis take long to get to the rank and on some occassions they operate quickly. However, commuters use this mode of transportation without being aware of the timebling scheduling. Commuters use this mode mostly as it deliver commuters close to places of interest penatrating inside locations.

7 MOBILE APP IN REAL-TIME INFORMATION OF PUBLIC TRANSPORTATION

Previously, a passenger could, at best, come to know when a bus or a train left a certain station and when it reached another station. This was possible only due to human communication because someone recorded the time of arrival and departure at each station and conveyed this through a telephone system or a written report (Haris, et al., 2019). It was not possible to track the movement of the bus or train between successive stations. As a result, it was not possible to inform waiting passengers at a bus stop as to when their next bus was due. Commuters either depended on a pre-published schedule and hoped it was reliable, asked other waiting commuters, or just tried their luck. In contemporary urban public transport, it is possible not only to track the location of a bus or a train between stations' but it is also possible to know how fast it is moving and get a more precise estimation of when it would arrive. In fact, it is also possible to get a complete mapping of all public transport systems that a passenger proposes to use over a journey. The use of ICT has since become crucial to communicate real time information to commuters without guessing and relying on past experiences. Further, when one needed a taxi, the most common way of getting one was to get on to the street and flag one there. There was uncertainty on when one would arrive and, at odd hours of day, whether one would arrive at all.

The paper has indicated the modes of urban public transport that use ICT for information dissemination which indicated that this system provides information easy and commuters can be able to plan their daily trips and travelling becomes more simple even when switch inbetweens are neccessary. With the introduction of online application for minibus taxis can also make ridership simple for commuters wereby commuters book taxis online, or through an app, and track their movement until they arrive at the

passenger's doorstep. This saves the passenger from the stress of waiting endlessly, not knowing when a taxi would arrive.

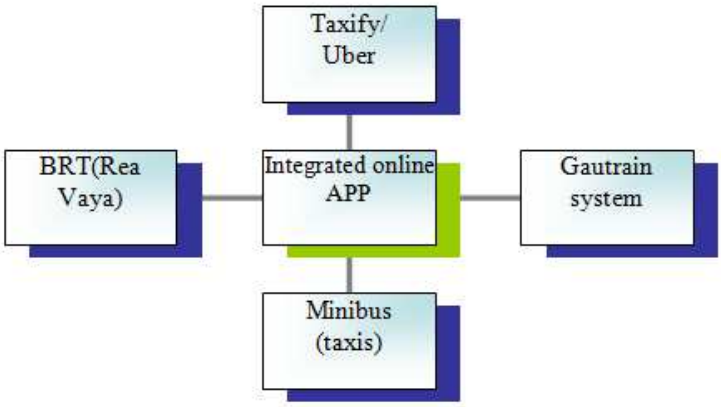

Figure 7: Integrated Information Dissemination for UPT [Source: Author, 2021]

The above figure 7 indicates an online information dissemination that can be used to integrate the different modes of public transportation that are mostly used in the city of Johannesburg. Commuters can login to an app indicating all these modes of public transport availability, real-time tracking and the fastest mode to reach the desired destination and allow commuters to make calculations for smooth switch in-betweens to create seamless travelling. The application could be used to book trips for any public transport mode and allow a commuter to connect trips switching from Gautrain system to uber/taxify or from Rea Vaya to a taxi. With such communication between these mostly used modes of public transport in the city, commuting would be much quicker and could attract more private vehicle owner to switch to public transport. Therefore, a positive change as this could reduce the traffic congestion challenge having roads that are mostly used by urban public tranport.

8 CONCLUSION

The world is making a rapid transition towards the fourth industrial revolution that is mainly characterized by technology and the internet. The latest technological innovations are rapidly and radically transforming the transport sector, creating the base for mobility solutions, which, accompanied to the cultural and socio-economic changes taking place all over the world, open the door to new future scenarios (Coppola and Silvestri, 2019). The use of Information and Communications Technology together with the Global Positioning System assists all stakeholders in urban public transportation to know the number of trips taken in a day for every vehicle and the time it used to travel. This in turn helps vehicle owners and operators with accountability and not being robbed by drivers. Commuters prefer multimodality as compared to only one option for public transportation. This helps the commuter utilize all available transport options to the current situation they find themselves in. This answers the questions of modern commuter's choice since commuters can choose from a wide range of public transport systems and what can assist them to reach such decisions. Through the use technology, it is possible not only to track the location of a bus, taxi or a train between stations, but it is also possible to know how fast it is moving and get a more precise estimation of when it would arrive. In fact, it is also possible to get a complete mapping of all public transport systems that a passenger proposes to use over a journey. Sophisticated apps developed by many public transport operators allow a passenger to plan his or her journey across multiple modes, with an accurate estimation of the time it would take to complete the journey.

The demployment of technology is beneficial to contemporary urban public transport in that commuters avoid catching taxis on the streets by signalling their destinations, which has proven not to be safe. Taxis can be booked online which means reliable departure and arrival times. This will notify people in case of emergency in the traffic flow and assist commuters not to stress by not knowing when a taxi will arrive. Taxis can even be booked before they depart from the taxi rank, and the current systems for minibus taxis can stll be used for commuters who prefer the system of going to taxi ranks.

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9 RECOMMENDATIONS

The study has revealed the most used public transport modes in the City of Johanesburg which function differently and these modes of public transport they function from the early hours of the morning till late hours of the evening. Therefore, recommends an online information dissemination application for both formal and informal public transportation application that will inform commuters the real-time information whereabouts of the transportation modes, departure and arrivals time as to assist commuters to plan they trips properly. Further, assist commuters which mode is good for commuting at that particular moment indicating traffic congestions and delays, also assisting with the integration for seamless travelling on how commuters can switch inbetween different modes for smooth commuting with no delays.

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