ACTIVITY PARTICIPATION AND PERCEPTIONS ON INFORMAL PUBLIC TRANSPORT AND BUS RAPID TRANSIT IN DAR ES SALAAM CITY

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ABSTRACT

This paper seeks to understand out-of-home activity participation of inhabitants in Dar es Salaam (DES), as well as their perceptions towards Informal Public Transport (IPT) and Bus Rapid Transit (BRT) in supporting these activities. IPT is burdened by poor roads, traffic congestion and high transport demand. IPT without fixed schedules (e.g., mini-buses, motorcycles and tricycles) is increasingly used as a means of transport for different trips. Many developing cities in the world are seeking to replace informal public transport services with formal bus rapid transit lines. However, little is known regarding the ability of the IPT and the BRT in supporting out-of-home activity participation of the inhabitants. In this paper, we report on a study in Dar es Salaam exploring the relative contribution of each type of service. The study encompasses Focus Group Discussions (FGDs), Participatory Geographical Information Systems (PGIS) and questionnaires, carried out both in a study zone close to a planned BRT corridor, as well as in a peri-urban location. The findings show that IPT plays an important role as a means of participation in daily activities like work, education, shopping and social matters; and is perceived to be important and flexible in providing access to both high and low density unplanned settlements. The planned BRT system is perceived to benefit specific groups of people, especially individuals with permanent offices in and around the city centre, particularly professional workers. This paper sheds light on how the two systems are perceived by the local people, and can inform policy makers about possible improvements in PT systems to support activity participation of their inhabitants.

Keywords: Informal public transport, Bus Rapid Transit, out-of-home activity participation

1 INTRODUCTION

Public transport (PT) is a core factor for improving the livelihoods of many people in developing cities (Alberts et al., 2016; Lucas and Porter, 2016), as it offers an opportunity for individuals to participate in out-of-home activities such as work, shopping, education and social matters (Adeel et al., 2016; Esson et al., 2016;Sietchiping et al., 2012). However, in many places, PT has been facing critical challenges that reduces its ability to support out-of-home activity participation of inhabitants, including poor access to bus services, a lack of travel alternatives as well as high transport demand (Behrens et al., 2015; Diaz Olvera et al., 2013; Woolf and Joubert, 2013).

In Dar es Salaam (DES), one of the fastest growing cities in Africa, more than 65% of its population depends on PT provided by Informal Public Transport (IPT) modes (i.e., minibuses (*daladala*), motorcycles and tricycles) for their mobility needs. DES is projected to have 6.8 million inhabitants by 2030, that will generate 9 million trips per day (Behrens et al., 2015; Madinda and Mfinanga, 2013). However, existing PT is constrained by inadequate road connectivity, long waiting times, poor local road conditions and extreme traffic congestion on major urban roads, impeding an undisturbed flow of buses. Besides, PT services are mainly concentrated along the major roads and most profitable routes, with little penetration to the neighbourhoods that are far away from the major roads. Therefore, commuting in peri-urban areas (i.e., newly urbanized zones at the fringes of cities) and in remote high density settlements is becoming difficult, especially for low income individuals who entirely depend on PT (Kombe, 2005; Mkalawa and Haixiao, 2014). About 75% of the inhabitants of DES live in such high density unplanned settlements, which are home to a mix of high, middle and low income households (Rasmussen, 2013; Hill and Lindner, 2010). The majority of the residents in these settlements are low income self-employed, and their income sources are mainly from commercial or micro enterprises like construction, carpentry, street vending and urban farming. The city land use planning has not yet located social amenities in the neighbourhoods of these residential areas (Hill and Lindner, 2010), which leads to an increase of both distances and motorized trips to the Central Business District (CBD) where most social services (e.g., public offices, retail, markets and referral hospitals) are located.

As reliable formal PT is lacking (not existing) to support travel activities of many inhabitants, IPT services, mainly in the form of minibuses, were introduced by private, often small, entrepreneurs in the 1980s (Kanyama et al, 2004). The existence of IPT was initially considered as a temporary condition, but for a number of reasons, including lack of public funds, rapid and uncontrolled urban sprawl and the complexity and magnitude of the transport problems in the city, IPT services are expected to continue operating for a long time (Cervero and Golub, 2007; Guillen et al., 2013; Mitric, 2013;). IPT is an unorganized system operating without fixed schedules and customized to meet passengers travel demand (e.g., passengers can be picked up and dropped anywhere). Informal minibuses or so-called *daladala* with a carrying capacity of between 25 to 34 passengers, do have specific routes to operate, but in most cases only operate on the most profitable routes with many passengers. In recent years, besides these *daladala*, other IPT modes like motorcycles (*bodaboda*) and tricycles (*bajaji*) have emerged in different parts of the city, attempting to offer alternative solutions for the growing transport challenges of inhabitants including areas uncovered with *daladala* bus services. Motorcycles and tricycles, with a carrying capacity ranging from one to four passengers, are gaining popularity due to their ability to maneuver traffic congestion and to operate under poor road conditions. They by and large operate as (shared) taxis and are thus not limited to a particular route.

To overcome the transport challenges, the government has decided to implement a Bus Rapid Transit (BRT) system, in order to offer affordable (ability to make necessary journey to work, school, health or other social services etc.) and efficient mobility for the urban population, leading to a better quality of life (Lizárraga et al., 2014). BRT systems have shown to become a popular solution for urban public transport problems (Kaenzig et al., 2010; Paget-Seekins, 2015)*;* also in African cities e.g., Lagos, Cape Town, DES, and Kampala where the BRT system is expected to revive the image of PT through a modern system that utilizes high quality buses and with a high capacity of passengers per trip (Stanley and Lucas, 2013; Venter, 2016; Vermeiren et al., 2015). In DES, the planned BRT system (with schedules, high capacity buses and dedicated lane) has been named Dar es Salaam Rapid Transit (DART). The DART first phase (Figure 1), consists of 20.9km along Morogoro trunk road from CBD to the west direction (in Kimara area), and started operating in May 2016.
However, little is known about the role of the implementation of this DART system in supporting the out-of-home activity participation of individuals in DES; neither about the role of IPT in supporting their activity participation. These specific studies: 'political economy of an urban mega project' (Rizzo, 2015), 'minibus transport operational problems' (Madinda and Mfinanga, 2013), 'Paradoxes of establishing a mass rapid transit' (Ka'bange et al, 2014) have created a platform for this research study.

Therefore, this study focuses on the current use of, and perceptions towards, IPT services to support out-of-home activity participation of the inhabitants in DES; as well as their perceptions towards the planned DART system in supporting their activity participation. This study took place prior to the opening of the DART service in order to understand people's perceptions about the system before making use of it. Based on this, it is also possible to see in a follow-up study whether these perceptions will change over time, after implementation of the DART system.

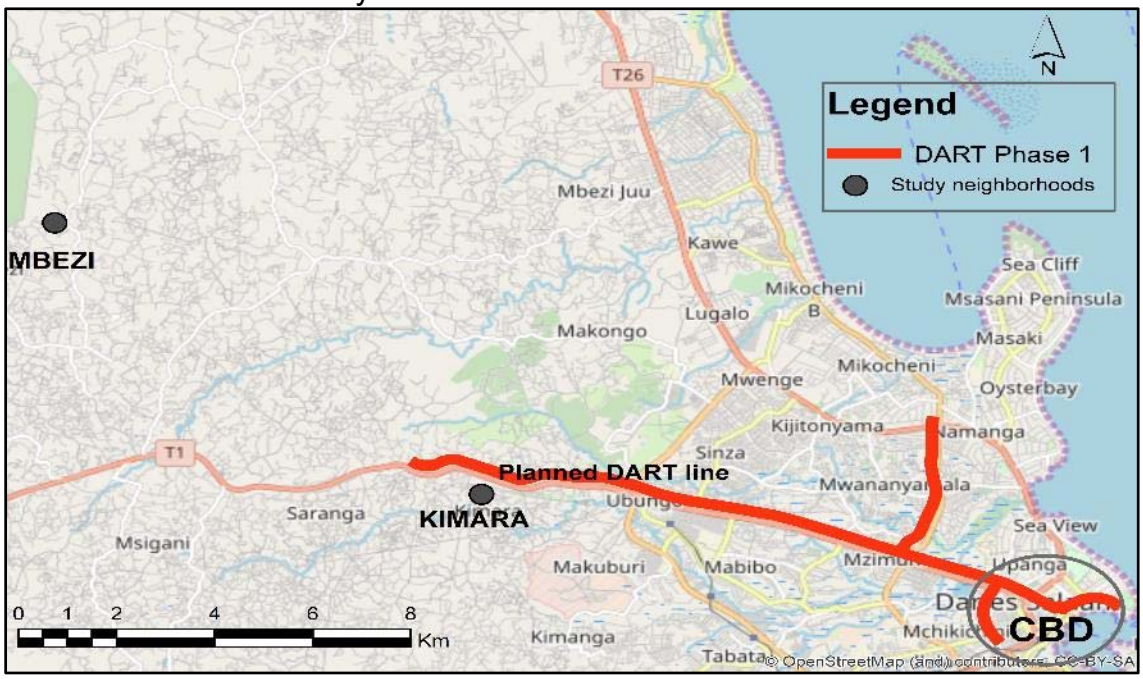

Figure 1 The two study areas Mbezi (peri-urban) and Kimara (adjacent to the planned DART line)

2 METHODOLOGY

2.1 Experimental design

The study was conducted at the beginning of 2016 before commencement of the Phase 1 DART service. Two study areas were selected based on their proximity to the planned DART corridor as well as the distance to the CBD (zone of a concentration of the services and government offices in Figure 1), which indicates variation in mobility demand between the two neighbourhoods. The first study zone, Kimara, is located adjacent to the DART system and about 15km from the CBD. The area is located along the Morogoro road, one of the main arterial transport routes to the CBD. The second study zone, Mbezi, is a peri-urban area located about 30km from the CBD. The neighbourhoods in this area are facing challenges to access PT services due to poor road conditions and a lack of connectivity.

Focus Group Discussions (FGDs) and Participatory Geographic Information System (PGIS) were used to capture users' perceptions about IPT and DART services, and to get more insights about their current travel patterns (McCray and Brais, 2007; Shay et al., 2016). A questionnaire survey was used to collect socio-economic characteristics of the participants such as age, gender, education, employment, marital status and vehicle ownership. The questionnaires were administered to the participants before the FGD sessions. A total of four FGDs were conducted in the two study sites, with an average of 10 participants in each FGD (total number of participants = 41). Identification of the participants was done by the researcher in co-operation with local government leaders and was based on pre-determined inclusion factors (both genders; students, retired, unemployed and employed people; both car owners and non-car owners; etc.). The participants from the two neighbourhoods were approached in person by their respective local leaders (neighbourhoods elected councillors) who informed them about the FGDs sessions and delivered official invitation letters. Besides, individuals were free to either participate or not depending on his/her willingness. In this study, these local leaders were not part of the participants and thus, were not involved in the discussions. FGD methods are useful to explore personal experiences and daily lifestyles. FGDs were used to gain insights about common or different perceptions on IPT and planned DART systems in respect to participants' activity participation.

The second method is Participatory Geographic Information system (PGIS) which refers to the integration of local knowledge in a GIS (Shay et al., 2016), allowing participants to share their travel patterns in space by indicating on the map their most visited areas for shopping, work and social activities. Two A0-size printed satellite images of DES city were used, displaying names and locations of the major centres, planned DART lines, and existing local and major roads. To enable participants to indicate their most important areas and trips on the map, stickers of different colour were used to represent different types of activity participation. The participatory mapping exercises were administered at the end of the FGD session. Through interaction among the participants, the research assistants and the lead researcher, activity destinations were located as precisely as possible on the map.

2.2 Data analysis

Data analysis was facilitated by the following software packages: SPSS 24, Atlas ti.7 and ArcGIS 10.3. SPSS was used for descriptive analysis (frequency tabulation) of participants' socio-economic characteristics. Atlas ti.7 was used for analysing transcribed FGD sessions and interpretation of key issues from participants' discussions. ArcGIS was used for PGIS analysis, which involved georeferencing the scanned A0 images, digitization of the participants' visited destinations for various activities and producing points shapefiles for geoprocessing analyses like spatial density (Kernel density). The results are presented in the below tables, figures and direct quotes.

2.3 Socio-economic characteristics of the participants

Most participants were middle-aged or older, with a few professional workers and private car owners. The age range of the participants in both study neighbourhoods' were from the mid-20s to 50s (Table 1). Many participants were self-employed and active users of the PT. There was almost equal balance in number of females and males participants in this study.

Table 1 The Socio-economic characteristics of participants (n=41)

Characteristics	Mbezi (%)	Kimara (%)
AGE		
≤25	9.5	15
26-35	19	25
36-45	33.3	20
46-55)	23.8	15
56+	14.3	25
Gender		
M	47.6	50
F	52.4	50
Marital status		
Single	19	30
Married	71.4	65
Divorced	9.5	-
Widow	-	5
Education		
Primary	52.4	50
Secondary	33.3	30
Higher	14.3	20
Work		
Full-time	19	15
Part-time	14.3	20
Self-employed	38.1	35
Unemployed	4.8	10
Retired	14.3	10
Student	9.5	10
Income		
<1500Rand	25	55
1500-6000Rand	50	25
>6000Rand	25	20
Travel frequency		
Daily	71.4	60
Weekly	9.5	10
Several times in a week	14.3	5
Monthly	4.8	25

3 RESULTS

3.1 Participants' activity participation based on PGIS

The results of the PGIS (Figure 2), visualize the types of activities conducted at different destinations. The map A in the figure 2 below shows activity destinations of the peri-urban neighbourhood, while the map B is for neighbourhood adjacent to the DART line. As shown on both maps, the dots for social activity are spatially distributed in different parts of the city. The dots for shopping are concentrated mostly around the CBD and few dots to the centres outside the CBD, while for work activity concentration of dots are around the CBD and within the neighbourhoods. This shows that the spatial activity patterns of the participants requires consideration of the first and last mile connectivity to support the use of the planned DART system for individuals residing in peri-urban neighbourhood as well as for activities conducted outside the planned DART line (e.g., social activity).

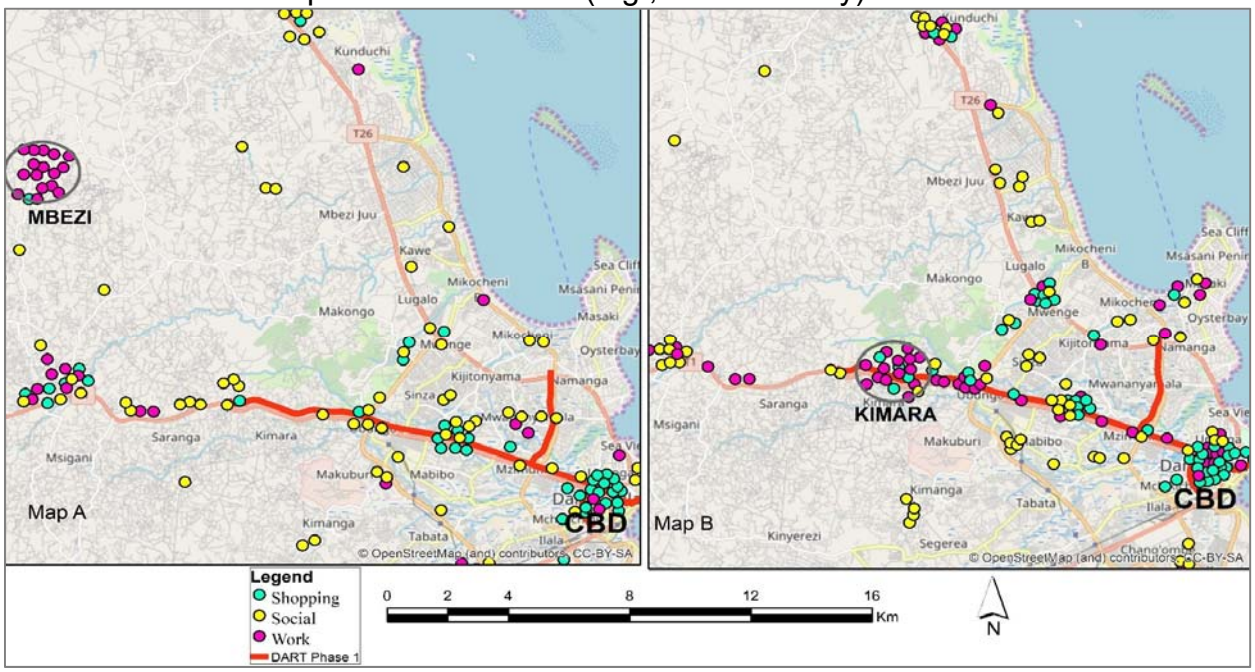

Figure 2 Locations of activities carried out by respondents of peri-urban area and adjacent to the DART line

Figure 3 visualizes areas of high and low concentrations of activities in density maps by colour variations. The ellipses included on the maps describe variation in spatial coverage of activity participation of the two neighbourhoods. The spatial areas within the ellipses (i.e., visited destinations), cover areas that are within and outside the planned DART system.

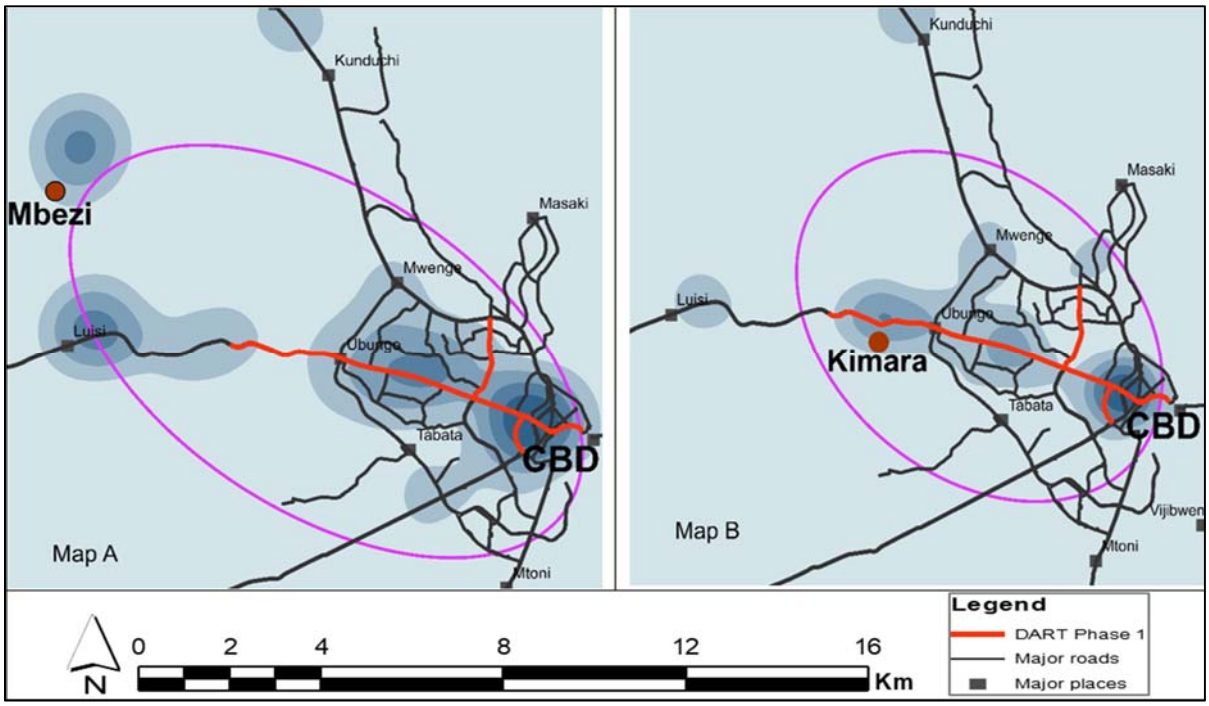

Figure 3 Spatial concentration and directional distribution of travel activities for Mbezi-periurban (Map A) and Kimara-adjacent to DART line (Map B)

3.2 Focus group discussions

Data from FGDs were in the form of recorded audio files and field notes taken from the discussions. These data were transcribed and coded using Atlas.ti7, whereby key issues and important direct quotes from participants were identified and presented below.

3.2.1 Travel constraints: Mode availability and travel constraints varied between the two study areas. Participants identified several travel difficulties (e.g., long waiting and traveling time, financial costs, and poor connectivity) which they experienced within their neighbourhoods and along major roads. Participants of the Mbezi study area experienced more travel challenges as compared to participants of Kimara (adjacent to the DART).

> "We spend more than 1 hour just to commute a short distance!' We do not have a bus station, the nearest bus station is located far from here [authors' comment: estimated distance: 11 km from trunk road]. How do they expect us to walk for such a long distance?" (Female respondent, 30 years, Mbezi). This means, walking is not convenient for such long distances (e.g., 11km).

3.3 Perceptions on informal public transport

The following attributes of the IPT were considered to be important by participants: time efficiency, flexibility, mode availability, and access to high and low density unplanned areas.

3.3.1 Efficiency in travel time: IPT modes such as motorcycles and tricycles are considered particularly efficient to get around in congested circumstances, as they eliminate the need to walk to and wait at a bus stop, hence reduce time burdens. Waiting and traveling time was considered as very important for the use of IPT.

3.3.2 Flexibility of the modes: Employment opportunities of many people depend on self-employed activities that are conducted in different locations, of which some of them do not

have fixed workplaces, e.g. petty trading (like fish vending). Most of IPT modes respond well to the travel needs of individuals involved in these self-employed activities.

> *"*I normally use the motorcycle to reach my customers. Some of them live in remote areas and the road is impassable, but motorcycles can penetrate" (Female respondent, 29 years, Mbezi).

3.3.3 Door-to-door services: The behaviour of motorcycles and tricycles in providing door-to-door services was perceived as an important factor for using them, especially by women (they travel to the market to buy food items). It was viewed as an alternative means of transport for those without private car and those who cannot afford a taxi.

> "I use motorcycle services because it helps a lot, you can call a *bodaboda* rider to pick you up at your home to the market, or wherever you want to go" (Female respondent, 32 years, Mbezi).

3.3.4 Access to high and low density unplanned areas: In Mbezi, the coverage of the planned PT network is inadequate (spatially limited), and participants were forced to walk long distances of approximately 11km to reach officially designated bus stops along the trunk road. Therefore, IPT is mostly used for their trips to these stops as walking is not convenient for such distance of 11km (time consuming, unfavourable weather, and dangerous (in terms of safety and security). In area adjacent to DART line, the distance between some homes to the closest officially located bus stops is estimated to be 1-2 km.

> "Nowadays, no place cannot be reached, motorcycles enables us to work and live any place. Even if you don't have a private car, you will find tricycles and motorcycles in almost every place you go" (Male respondent, 45 years, self-employed, Mbezi).

3.3.5 Ability to transport people and their goods: Traveling with goods in a *daladala* minibus is a big challenge particularly in peak and rush hours.

> "Sometimes you may decide not to carry anything when commuting with a *daladala*, just because you will not be treated well by the conductor. However, our travels become easier when using a motorcycle or tricycle" (Female respondent, 29 years, Kimara area). This implies that PT is required to move passengers and their goods.

3.4 IPT and activity participation

This section presents the links between IPT modes and activity participation. The main question was how IPT is used to support various types of activity participation.

3.4.1 Access to work locations: Participants are involved in different types of work activities such as plumbing, petty trading, fish vending and welding, most of which have no permanent locations. For example, a person involved in housing construction can travel any direction, depending on where opportunities are available. Therefore, reliable and flexible transport systems capable of responding to different local contexts are required

> "I have a car, but I prefer to use *bodaboda* because I can spend only 20 minutes from Kimara to Morocco area. Using a car, one can spend more than 2 hours" (Male respondent, 31 years, full-time employed, Kimara)

3.4.2 Access to health care services. IPT is used to access health centres and hospitals for health care services. Participants explained that for a pregnant mother it is very hard to know the exact time when complication will start, as it can happen at any time. In case it happens in the night, they have to call a motorcycle rider to come and pick up the mother to the hospital. In some cases, a tricycle is preferred above a motorcycle because it can accommodate up to four passengers at once.

> "If you have a sick person, tricycles help us to rush to the hospital; the system is affordable as compared to the hired taxi. For example, if I want to go to Muhimbili National Hospital, a tricycle can charge not more than Tsh.10,000 (Rand 56.5) but a taxi is more than Tsh.20,000 (Rand 113)" (Male respondent, 35 years, Kimara).

3.4.3 Access to education: IPT modes like motorcycles are considered to be efficient for students, especially during exam periods, as it was noted that a lack of school buses and reliable PT impose travel challenges. “I use motorcycles during exams; it is the only mode, which can help me to be on time in the examination room" (Male respondent, 18 years, Mbezi).
3.4.4 Participation in social matters: Participation in social activities reduces the sense of isolation and empower poor individuals in times of vulnerability; for example, during mourning a death, floods, sickness and other disasters. Other social trips include attending the wedding ceremonies, church, mosque and meeting with friends. This means IPT is important for the creation of social capital.

3.5 Negative impacts of IPT

The negative aspects of IPT which respondents reported on were the reckless behaviour of the motorcycle riders contributed by a lack of appropriate driving training and proper control of their services. The mini-buses were regarded to be of poor quality (e.g., old buses in poor mechanical condition) that may increase travel time due to breakdown on the way. IPT was also considered to expose individuals to additional risks (e.g., security and safety issues). Participants emphasized that upgrading of these modes and proper control of their reckless behaviour through training, would make the IPT system more helpful to the users.

3.6 Perceptions about the proposed DART system

The focus group discussions about the DART system was based on the physical location of the road infrastructure, the bus stations, and the expected quality of the buses (e.g., large) (Mallqui and Pojani, 2017). Based on these physical attributes of DART system (location of DART line, stops, and buses), maps and photos were used to facilitate discussion. The DART fares were not discussed because during the data collection process, the authorities and stakeholders were still in discussion on the amount of the fares to be charged. Although it was unrealistic to discuss DART fare, but it emerged from participants as important attribute of their concern for DART ridership, especially for street vendors and unemployed.

3.6.1 Informal activities vs. professional jobs: The DART was perceived to be suitable for individuals with permanent workplaces around the CBD, particularly for professional employees. For poor people, the DART would be used for shopping around the CBD. The system was perceived to exclude other activities conducted outside the CBD.

> “You know, for us who are engaged in self-employment such as fish vendors around the streets, the DART is not flexible to support these kinds of activities” (Female respondent, 37 years, self-employed, Mbezi).

3.6.2 DART for specific class (higher class): The DART system was also associated with specific transport users like car users and high-income earners. Since the DART system seems to use high quality buses, participants associate this with an increase of the transport fare, higher than the fare charged by IPT services (*daladala*).

> "The bus seems to be luxurious and of high quality, which reflects the lifestyles of rich people, but for who is travelling with boxes of tomatoes, fish buckets and vegetables, it is hard to use the system" (Female respondent, 43 years, petty trader, Kimara).

3.6.3 Costs for peri-urban communities: Based on the physical location of the DART line, the number of transfers for individuals commuting from peri-urban area to the CBD will change from one (direct route) to two transfers. It was noted that individuals commuting from Mbezi bus stop to the CBD are required to make a transfer at the Kimara DART terminal when using the DART service, which is perceived to increase travel costs and route inconveniences.

3.6.4 Saving travel time: The use of exclusive lanes in DART was viewed as positive in minimizing travel times as compared to the existing PT that operates under the mixed traffic lanes. “We are forced to use motorcycle to go downtown because of traffic jam" (Female respondent, 27 years, full-time worker, Kimara)

4 DISCUSSION AND CONCLUSION

The study showed how IPT and proposed DART were perceived by the inhabitants of DES in relation to their activity participation. The findings cannot be generalized but provide relevant insights and deeper understanding about the two systems from local people perspective. The study is also useful in today’s scenarios of developing cities where a large number of people live and work in areas without adequate PT connection.

The use of IPT among participants was perceived as a solution for high travel demand, lack of planned PT services within their neighbourhoods and travelled destinations. The existing travel difficulties (e.g., long waiting and traveling time) along major roads, the use of IPT modes, especially motorcycles and tricycles, is considered as an important opportunity to participate in different activities that are carried out in any destination, as they do not operate on any fixed route. Thus, the vital role of IPT modes in supporting livelihood activities and reducing the risk of exclusion cannot be underestimated from these neighbourhoods. This is also in line with literature by (Lucas and Porter, 2016).

The flexibility of IPT to respond to individuals’ activity participation provides insights about the need for a feasible PT in a real local context. As the DART system would integrate high capacity buses on fixed route, the system seems most applicable in densely populated areas and on busy and congested roads. In unplanned settlements and less densely populated areas, the DART system might bring additional travel costs due to new interchange points (increased number of transfers) and fares. Consideration for service coverage of PT within neighbourhoods is fundamental, especially for individuals without access to private cars, living far away from a DART system, and those involved in low-income self-employment outside the CBD. Planning should include both inner city as well as the peri-urban areas.

Participants of this study perceived the implementation of the DART system as primarily serving the high-income groups, and not the poor “the project has come to serve the big fish and not the small fish” (Male respondent, 50 years, Mbezi). The proposed DART system is positively perceived as a mechanism to ease traffic congestion.

Every mode of transport has its own strengths or an opportunity to offer. Consideration should be given to integrate various modes along with first and last mile connectivity for easy access to DART stations or stops. In these study neighbourhoods, the presence of micro vehicles (e.g., tricycles) with the capacity to carry a minimum number of passengers, is more flexible, and perceived to be more useful for reducing waiting times. Reports from the participants showed that, in situations where a *daladala* bus is available, especially in non-peak hours, the bus tends to wait longer for passengers and only departs when it is full.

The current travel patterns of activity distributions require an intervention to address core barriers to the use of DART system (Mallqui and Pojani, 2017; Venter, 2016).

Extensive study in this area will enable adaptation of the planned DART system to the unique environment of their location (to best suit the local needs).

IPT services offered an alternative solution in areas where planned (formal) PT is inadequate or not covered, particularly in peri-urban areas, as the findings show that individuals living far away from major roads experience other travel constraints such as lack of connectivity and poor road conditions, and high transport costs. The IPT system can be seen as a solution for reducing transport exclusion and supporting out-of-home activity participation for under-served individuals and neighbourhoods located far away from planned trunk roads. The planned DART line was perceived as only concentrated on highly congested roads to improve access to the CBD. The need for PT improvements which meet door-to-door connectivity is important for persons living far away from the planned DART line and entirely depended on PT as well as for persons relying on private car. The methods (e.g., FGDs and PGIS) involved in this particular study can be seen as useful for exploring the constraints and opportunities of the DART system to a wide variety of contexts.

4.1 Limitations and recommendations

The main purpose of the study is to put forward a broad picture about the way IPT and the planned DART system are perceived by the people. The empirical work presented is not a statistically representative of the entire population in the city. This study is significant for improving public transport in the local context. The perceptions about the DART system help to uncover the ability of the system to support activity participation. To minimize hypothetical bias, the physical aspects of the DART system such as the location of the DART line, stops, bus photos and routes (use of maps) were mainly considered to gain insights about the system. Further research can be done to quantify the travel behaviour of the IPT users, and changes in travel behaviour including peoples' perceptions after DART system.

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