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Transport Mobility Analysis for Informal Settlements in Dar es salaam, Tanzania

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ABSTRACT

Dar es Salaam is one of the world's fastest growing cities and is expected to be the third largest by 2100 with a population of 76 million. Dar es Salaam city is made of multiple neighbourhoods that are very diverse in terms of socio-economic status, gender, age and prevalent activities. One of the biggest challenges facing the city of Dar es Salaam is urban sprawl due to informal settlements that in turn leads to very long travel time and hinders equal mobility and accessibility of labour and goods. This study found that the current mobility vision for Dar es Salaam city that bases on transit-oriented development can help to alleviate transit pressure to the current mono-centric city, although integration of the vision to informal settlements that are the current majority of the land use is still lacking. The study also found that the current regularisation strategies of informal settlements provide an opportunity for urban mobility. However, the resulting mobility networks are not sufficient to meet the demand of the government mobility vision. To capture the future rapid population growth in the city, this study recommends a back-casting strategy that looks on the future needs of the population including residency vis-à-vis mobility to establish current new transit corridors passing through redeveloped informal settlements.

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INTRODUCTION

Dar es Salaam is one of the fastest growing cities in Africa. With a population growth rate of 6.5% it is expected to reach a population of over 10 million residents by the year 2030 and a population of 73.7 million residents by the year 2100; making it the third largest city in the World after Lagos (88.3 million) and Kinshasa (73.7

million) (Hoornweg & Pope, 2017). Dar es Salaam's population has been growing rapidly, driven by rural-to-urban migration, natural population growth, and the city's attractiveness as an economic hub (Brennan & Burton, 2007). In 2002, the city had a population of around 2.5 million, and by the year 2021, it had grown to about 5.7 million (NBS, 2022).

As other cities in developing countries especially in Sub-Saharan Africa, this rapid population growth has resulted in a city that shows characteristics of massive urban sprawl with informal settlements that often lack access to basic services including transportation (Magigi & Bie, 2018). A World Bank report (Lall et al., 2017) shows that African cities are 29% more expensive, are more crowded but disconnected leading to having 40% fewer neighbours to interact with compared to countries in Latin America and Asia with similar income. The dual challenge of informal settlement leading to urban sprawl, and the lack of a functioning public transport network reaching all residents in Dar es Salaam has led to the need of a sustainable transformation strategy that can enhance the living standards of Dar es Salaam residents. Therefore, the aim of this paper is to analyse the best practices available in the country to reduce the effects caused by informal settlement and urban sprawl.

METHODS AND MATERIALS

This study is based on desk research about aspects that are relevant to mobility and informal settlements for the city of Dar es Salaam. Peer reviewed journal papers as well as other relevant official public

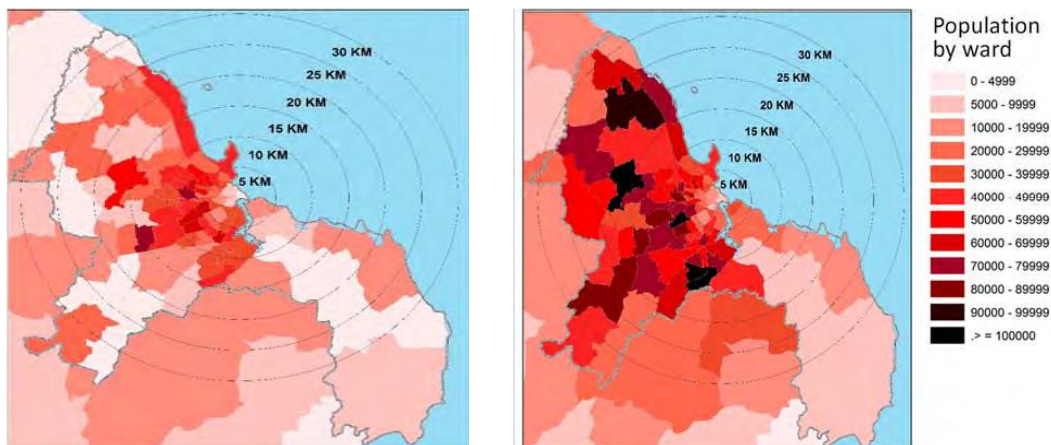
documents including reports were used to analyze urban mobility in relation to informal settlements. Physical observation of the case study area was also conducted to verify the study area condition.

DAR ES SALAAM OVERVIEW

Population growth

Dar es Salaam has been experiencing massive population growth surpassing expected projections. This is to the larger extent has been caused by rural-urban migration (Brennan & Burton, 2007) influenced by prospective economic opportunities offered in the city. Currently, the annual population growth rate of Dar es Salaam stands at 2.1% and is expected to continue along the same trend in the near future (NBS, 2022).

Population data from the National census of 2002 and 2012 shows that the majority of the population was living within the inner core of the city in 2002. However, the rapid change of population to the year 2012 is seen to be reflected with more people living towards the outer layer of the city (Figure 1) with population growth rate of up to more than 200% in some areas. The rapid urbanization of Dar es Salaam has led to urban sprawl (Magigi & Bie, 2018) from the formation of informal settlements.



Population in 2002 at 2.5 million.

Population in 2012 at 4.3 million.

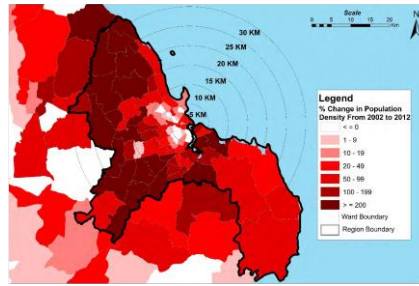


Figure 1: Population distribution and rate of change in Dar es Salaam (JICA, 2018).

Informal settlements

By definition informal settlements are residential area neighbourhoods where inhabitants have no security tenure vis-à-vis the land they inhabit; lack basic services and formal city infrastructure, where the housing stock may not comply with current planning and building regulations (UN-HABITAT, 2018).

Although informal settlements vary in the level of informality and the resulting services provided, Fekade (2000) notes that, almost all informal developments including those in South Africa, Peru, Pakistan, Indonesia, Turkey, and Cameroon share some attributes including:

- i. They are constructed by the inhabitants without any public assistance, with an intended aim of housing themselves, renting it out or both.
- ii. They are more prominent to the urban poor who are normally more challenged to follow formal procedures to access land or housing.
- iii. They are informally financed.
- iv. They are built locally using local building materials, skills, designs and indigenous technology.
- v. They generally are not in compliance with legal building codes and standards.
- vi. They display diversified housing units in terms of type and construction quality.
- vii. They are mostly built incrementally.

However, the informal settlements in Tanzania especially the ones in Dar es

Salaam are exceptional that they do not typically adhere to the mentioned characteristics. There are informal settlement communities of middle-income residents constructing housing in unregulated big plots with superior construction materials, design and technological knowhow. The informal settlements in Dar es Salaam can be categorized into two groups: homogeneous informal settlements, which are characterized by low or middle-income socio-economic groups, and heterogeneous informal settlements, comprised of both low-income and middle-income economic groups (Kalugila, 2014).

Past records show that informal settlements began to develop during the colonial period and continue to be a deep-rooted concern for Dar es Salaam City development authorities after a pressing rapid growth explosion since 1961 (Kombe & Kreibich, 2000a). This is due to rural urban migration, urban expansion boundaries extending villages to urban areas, lack of policy to manage the urban population explosion as well as inadequate provision of serviced land for housing (Boshe, 2007). Other factors maybe urban development without guidance, less bureaucratic access to plots in informal settlements, shortage of surveyed and serviced properties in urban areas, political economy, uncoordinated planning and poor planning (Williams, 2022).

Informal settlements come with many challenges including those related to access to basic social services including clean water, solid and liquid waste disposal, electricity, as well as easy access to

educational and health facilities. The previous master plans attempted albeit unsuccessfully to tackle this issue. By 1980 over 70 per cent of the population of Dar es Salaam City was already living in such areas (Sawio, 2008). Reduction of this percentage of informal settlements compared to the formal has remained a challenge only to continue to increasing to the current 75 per cent (Boshe, 2007). By 2013, there were about 100 unplanned settlements in the city and 75% of all residential houses in the city were found in these areas as indicated by Figure 2, (Rasmussen, 2013). Physically these settlements are characterized by single story house types in

various stages of completion, permanency status and construction material selection. They generally follow the traditional Swahili house design and neighbourhood pattern, a compact layout with an organic urban fabric (Rasmussen, 2013). Therefore, the overall spatial feature is characterized by a highly dense settlement; with increase in densification closer to the central business district. Informal settlements come with many challenges related to access to basic social services including clean water, solid and liquid waste disposal, electricity, as well as easy access to educational and health facilities. Another direct consequence of informal settlements is challenges related to urban mobility (Kironde, 2019).

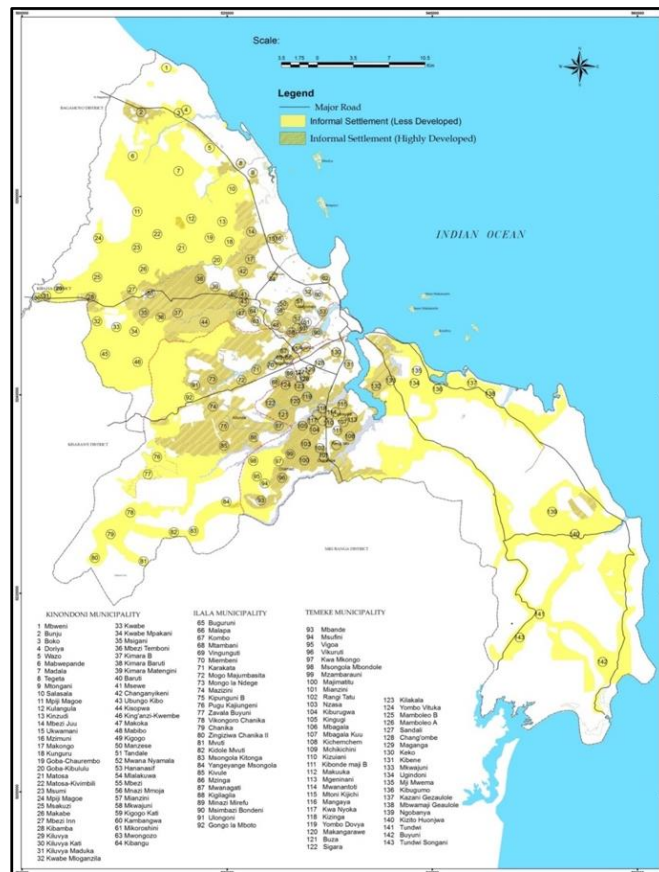


Figure 2: Informal settlements distribution in Dar es Salaam (Technical Supplement 5 Informal Settlements Dar es Salaam City Master Plan: 2012- 2032).

Transport System

Dar es Salaam is a palm shaped city and is characterized by a mono-centric urban and

administrative structure (Nkurunziza, 2013). The old city which is still the current central business district (CBD) is located near the port area. The city has four major

radial roads connecting the CBD to the outskirts of the city. Bagamoyo Road connects the CBD to the north, parallel to the coastline. This area is mainly residential area with small centers. On the other hand, Nyerere road connects the CBD to the south western part of the city and to the international airport. Area along this road was designated in the masterplans as an area for light industries. Morogoro and Kilwa roads connect to the north west and south east respectively (Figure 3).

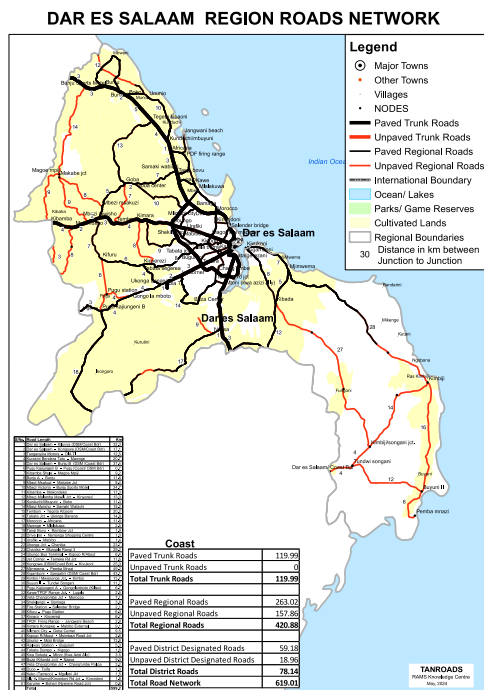


Figure 3: Arterial roads networks in Dar es Salaam (TANROADS, 2024).

Table 1: Comparison of growth of population and car ownership for 2007-2017 (JICA, 2018)

Item		2017 Survey	2007 Survey	Ratio
Car ownership	Population (1,000)	5,782	3,030	1.90
	Number of cars	191,825	78,477	2.44
	Car ownership ratio (household)	10.9%	10.0%	1.09
	Number of cars (1,000 person)	33.2	25.9	1.28
Total trips (1,000 trips/day)		8.674	2.848	3.05

While it is expected that this traffic demand would continue to increase with the increase in population, there is a challenge posed by the informality of settlements that renders it difficult to provide equal mobility

Intervening areas between these roads were planned to be developed for residential uses with hazardous areas deemed uninhabitable within these areas left as open spaces. However, rapid urbanization coupled with inadequate urban planning strategies and a quest for economic opportunities near the CBD, led to the development of informal settlements even in the deemed hazardous areas. These informal settlements consisting of both middle and low-income households are scattered all over Dar es Salaam contributing to urban sprawl and land underutilization (Lupala, 2002) challenging mobility and equal access to services.

The rapid urbanization of Dar es Salaam has led to increase demand in mobility. In 2017 alone, the total amount of trips in Dar es Salaam was 8.7 million per day, which is more than triple the figure found in a survey of 2007. During the same period, the population had a growth rate of only 1.9 times, while the traffic demand had a growth rate of 3.05 times. Car ownership also had a growth rate of 2.4 times when compared to the same period (Table 1) (JICA, 2018).

opportunities within different city areas. Most informal settlements do not provide transport accessibility in areas that are not neighbouring the main road. This brings the

need of regularization of informal settlements.

INTERPLAY BETWEEN URBANIZATION AND MOBILITY

Regularization of informal settlements

Land regularization in Tanzania had begun since the colonial era during the German and the British rule, whereas both emphasized land registration mainly for colonial settlers, traders and plantation owners. In contrast, the British recognized the dual structure ownership of the land, whereas the dominants acquired large-scale ownership properties. At the same time, the majorities under the customary law were restricted to small-scale landed properties. After the independence in 1961, the Tanganyika government neglected the registration of the land property of the people to secure their land. It focused on agriculture advancement through the Ujamaa Village-lization program. In contrast, in 1983, the Tanzania government introduced the National Agricultural policy that emphasized the private ownership of land to save the country's economy; as a result of solving one problem, another problem occurred that led to rural-urban migration of people in such vacant land that were owned irregularly without following rules (Kombe & Kreibich, 2000).

Tanzania adopted the Delhi Declaration by the United Nations Conference on Human Settlement in January 1966, signed by 171 countries worldwide. This emphasized the security of land tenure as a condition of sustainable shelter for urban development, which is to be applied to all, especially the people living in informal areas. Thus, in response, Tanzania introduced the land Regularization scheme through Act No. 4 of 1999 and later in 2000 in the National Human Settlement Development Policy of 2000 (URT, 1999; URT, 2000).

The Regularization approach used for Tanzania's informal settlement area is a community initiative form also termed self-regularization, where the Tanzania

government allows the residents to regularize their plots on their initiatives and resources. In contrast, the government plays the role of facilitator. The Minister declares the area for regularization either in her motion or upon request of the people.

For an area to have a regularization scheme according to the Land Act of 1999, it should fulfil the following conditions:

- i. The land it occupies has to be substantially built up.
- ii. The area is dramatically used for habitation.
- iii. Many people have lived in the settlement for a considerable period.
- iv. Despite the lack of any security of tenure, a substantial number of people appear to be investing in their houses.
- v. People living in the area and their C.B.O.s wish to participate in a scheme of regularization.
- vi. The area is likely to be declared a planning ordinance (URT, 1999).

Makongo Juu Settlement Case Study

Makongo is an administrative ward in Kinondoni district located about 17 km from the city centre of Dar es Salaam. According to the census conducted in 2022, Makongo had a population of 35,567 people (NBS, 2022) and is divided into four sub-wards: Changanyikeni, Makongo Juu, Mlalakuwa and Mbuyuni (Figure 4). Makongo Juu was originally a wild forest considered inhabitable by the government; during the 1930s and 1940s, the Greek settlers established sisal plantations with locals working as laborers for the plantations. As a result, they made settlements in the area to be close to their workplace.

After the decline of the sisal plantation in the 1950s and 1960s, people started to clear the bushes to get land to build their residential houses, hence resulting in clusters in settlement from the masterplan of 1979 designated Makongo as the green belt until 1985, the area was declared to be part of the urban as previously it was

considered to be at the peripheral of the city (Kalugila, 2014; Burra, 2004; Kironde, 2019).

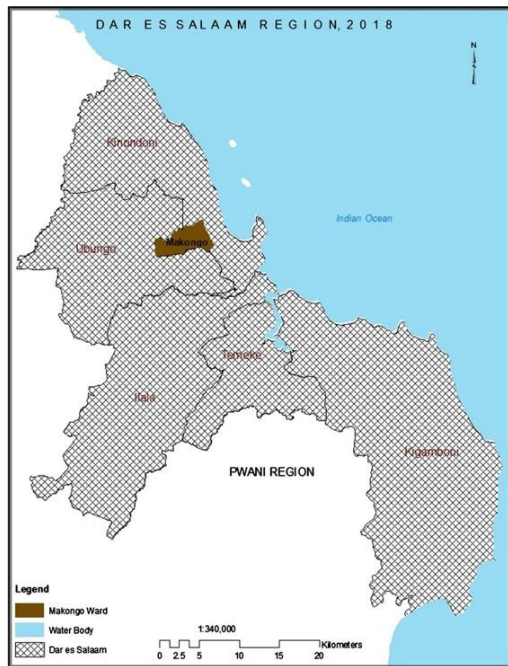


Figure 4: Makongo Administrative sub-ward (Kironde, 2019).

Makongo Juu is among the mixed-use informal settlements found in Dar es Salaam city with mixed demography of people of low and middle socio-income. The ward is neighbouring Ardhi University, University of Dar es Salaam, Water Institute and the Lugalo military barracks, and thus, the area has a mixed demography including university students, business-men, former ministers, politicians, academic professionals, top-ranking civil servants, and small vendors. Makongo juu settlement was able to undergo community-based approach for regularization since it met all the criteria set within the Land Act of 1999.

Regularization of Makongo Juu in Respect to Access Roads

The residents of Makongo Juu came together and formed a committee for the regularization of the area. Identification of ownership found that the plots varied in size and tenure status including certificates

of title, licenses for residence and sale agreements. A total of around 3200 plots were identified (Kironde, 2019).

A land use plan was developed that conducted minor changes to the boundaries of the plots to increase accessibility. Around 35,000 m² of land area was contributed by the land owners for access roads provision where an estimated 110 pieces of roads of various lengths and widths were contributed to public land without compromising their underlying functionality (Kironde, 2019). Where individual plots were small (below 90 m²) and thus difficult to provide access to each of them, the Unit Title approach was recommended (Lerise & Silayo, 2017). The recommended plan avoided demolition of areas along the major roads, and where absolute necessary, compensation was recommended to be handled by government authorities.

The current accessibility status shows that while land owners gave their land for development of road networks, the resulting condition is a collection of fragmented roads with different flexibility; not affording connectivity with areas that are further inland from the road. Moreover, the smaller access roads do not have enough space for proper drainage, while already increasing the surface runoff of the area, hence providing cause for land deterioration.

CONTEMPORARY PUBLIC TRANSPORT PLANNING

Mobility is one of the most critical factors to sustainable improvement of informal settlements (Andreasen & Møller-Jensen, 2017; Evans *et al.*, 2018; Oviedo *et al.*, 2021). While informal settlements' marginal location and municipal authorities' limited capacity to provide essential urban infrastructure reinforce disconnection and exclusion cycles in these areas (Hill *et al.*, 2014), it presents unique challenges and opportunities in transport and infrastructure planning.

Sustainable development of urban passenger transport in these regions requires a comprehensive approach that considers various factors. This includes the status of urban transport, demography, settlement patterns, and the distribution of stops in city transport routes (Spirin & Enin, 2022). Additionally, the development of effective and balanced transport policy packages, infrastructure, and spatial planning is crucial to achieve the same goal of bringing sustainability to urban transit (Ilchenko, 2021). As national governments seek to define sustainable development strategies for the transportation sector, it is essential to establish appropriate national policy frameworks (Ni *et. al.*, 2020; May, 2013). Furthermore, the development of sustainable transportation involves promoting efficient transport systems while reducing sub-optimal or harmful effects on public health, the natural environment,

economy, and urban planning (Szczuraszek & Chmielewski, 2018).

Under this consideration, the Government of Tanzania initiated strategies to enhance public transport networks to attain sustainability through the reduction of congestion in the city as one targeted goal. For this endeavour, the Government established Dar es Salaam Rapid Transit (DART), an agency responsible for overseeing public transit in Dar es Salaam. Under DART six Bus Rapid Transit (BRT) routes were planned along the four radial major roads from the CBD and two ring roads (Figure 5). The first route running along Morogoro road for 29.2 km came into effect from May, 2016. The second route along Kilwa road is currently (2024) under construction and expected to be operational by 2025 whilst Route 3 and 4 are planned to be operational by 2026.

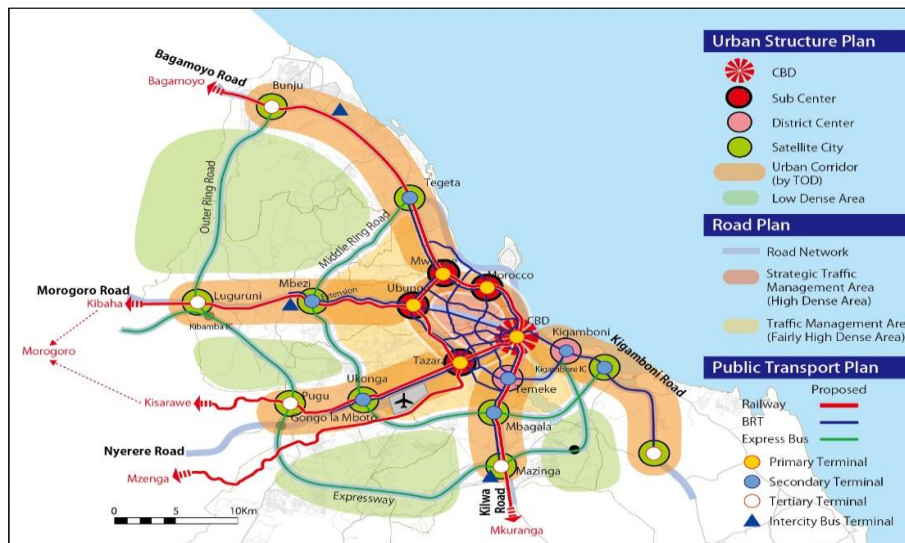


Figure 5: Transport plan of Dar es Salaam by the year 2040 (JICA, 2018).

The main vision behind this initiative is the development concept of urban transport as “Transit Oriented Mega City” since Dar es Salaam is expected to be one of the mega cities globally with a population of more than 10 million by 2040. This vision looks for the CBD to be connected with sub-centres and satellite cities through five radial roads and three circular urban corridors. This strategy envisions the CBD

to be decentralized, and transform the city to a poly-centric city, and hence elevating the mobility pressure to the CBD. Compact cities are also expected to be developed naturally along these transit corridors using Transit Oriented Development (TOD), providing economic densification of the city while improving mobility (JICA, 2018).

Figure 5 shows the expected transport network in the year 2040. The figure shows that the major transport roads avoid areas of informal settlements since the process of compensation to set for transport networks can be tedious and costly. Moreover, since the transport plan is also dependent on feeder roads that are planned to carry transit passengers from minor roads to the BRT main routes, the spatial arrangement of informal settlements can also be a source of concern.

INTEGRATION OF TOD IN REGENERATION OF INFORMAL SETTLEMENTS

When used effectively, transit-oriented development (TOD) can be used as a source of regeneration of informal settlements. However, studies suggest that it is necessary to consider adapting the land use and transportation system in determining the development pattern of the city (Dargahi et al., 2021). Comprehensive and detailed plans of the city should be prepared in accordance with the transportation planning plans bringing more affective change when BRT or other TOD routes passes through them. However, since areas around BRT targeted for transit-oriented development can increase land value and can be a cause for gentrification, government regulation intervention has to be prepared for retrofitting the informal settlement to allow for equal compensation and benefit of the TOD development (Kidokoro, 2020).

While formal settlements are generally identified by distinct 'buildings', 'plots', 'streets' and 'blocks' that are combined at different scales to produce an urban fabric (Scheer, 2016) and hence the transport routes such clear distinction is not found in informal settlements. However, projections show that 80% of the total building stock that will exist in developing countries in 2050 have not been constructed in 2014 (UN, 2014), clearly showing a necessary reconstruction need and an opportunity for replanning of informal settlements to

integrate development strategies including TODs.

By definition, the requirement for an effective TOD is a moderate to higher density compact mixed-use development/settlement, located within an easy five-to-ten-minute walk of a major transit stop (Alwehab & Al Ani, 2016). This gives a unique opportunity to create informal settlements redevelopment plans that mix residential, retail, office, open space, and public uses in a walkable environment (Carlton, 2009) that are integrated with major public transit routes. While the current regularisation of informal settlements plans in Tanzania are somewhat able to improve the conditions of a settlement as seen in the Makongo Juu case study, the integration of these settlements to TOD strategies are not visible. The current TOD strategies seem to avoid passing through large areas with informal settlements as seen in Figure 5 even though these areas have the largest portion of inhabitants.

As seen in the case of Makongo Juu which is found within the four nodes of Mbezi, Tegeta, Ubungo and Mwenge, the connection between the area with BRT for an instance is missing as well as the passage of major arterial roads. Even in its current regularized condition, feeder buses to reach residences within the area have not been proposed. This might be due to the disconnection of transport network within the area and its low population density.

Moreover, whilst it is expected for informal settlements that are found along the corridors of BRT to undergo redevelopment due to the influence of TOD strategies, redevelopment strategies set by the government are not yet available to guide private and public investment.

CONCLUSION

Transit oriented development is one of the strongest strategies for sustainable mobility in urban centres. Although the current mobility vision for Dar es Salaam city that bases on transit-oriented development can

help to alleviate transit pressure to the current mono-centric Dar es Salaam city, integration of the vision to informal settlements that are the current majority of the land use is still lacking. Even though the current regularisation strategies of informal settlements provide an opportunity for urban mobility, they lack strategies to integrate it with transit-oriented development vision set by the government. To capture the future rapid population growth in the city, a more holistic approach that capture the future needs of the population including residency vis-à-vis mobility is needed. New transit corridors passing through redeveloped informal settlements need to be established, and building and infrastructure current and future life cycle changes should be considered.

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