THE IMPACT ON PUBLIC TRANSPORTATION BY THE GROWTH OF INFORMAL SETTLEMENT IN SOUTH AFRICAN CITIES

BY

INNOCENT ZULU

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SUPERVISOR **PROF. JHC PRETORIUS**

CO-SUPERVISOR **MR LLS KRUGER**

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To the University of Johannesburg and all the Engineering Management programme lecturers.

Dedication

I would like to thank God for life and the blessings that HE has granted throughout my life. I would also like to thank my family, in particular, my wife Lumka who has been supportive during the difficulty in completing this mini-dissertation after the discovery of our son's autism diagnosis. She still encouraged me to finish this mini-dissertation at the critical time of my son's recovery programme.

I would also like to thank my son Tholu, for teaching patience.

Declaration

I at this moment declare that all the research work, except where relevant references have appropriately been acknowledged is my work.

Abstract

The purpose of the mini-dissertation was to investigate some of the necessary extents in urban public transportation in South African cities.

The preliminary findings show a symbiotic relationship linking informal settlements and public transport whereby issues of spatial planning and land use equally affect both elements.

This is explained twofold first; informal settlements continue to increase as South African cities continue to experience rapid urbanisation resulting in lower net urban densities that ultimately make existing public transportation systems unsustainable. Also, unviable due to high costs of maintaining the networks as well as transportation subsidies. Second, due to the apartheid legacy, public transport in South Africa served to promote fragmentation and exclusion of low-income and informal settlements.

The overall outcome of this is that inhabitants of informal settlements are forced to make expensive and time consuming journeys to access and enjoy the socioeconomic opportunities and activities offered in urban city centres. The core recommendation from this study is that the “development of a more spatially compact urban form” (Ffc.co.za) in the country’s cities through innovative spatial planning policies that aim to increase densities.

“By examining all uses of land in an integrated manner, it makes it possible to minimise conflicts, to make the most efficient trade-offs and to link social and economic development with environmental protection and enhancement, thus helping to achieve the objectives of sustainable development.”

(United Nations Sustainable Development, 1992)

Contents

1. CHAPTER ONE

1.1. Introduction

In many developing cities in South Africa, informal public transport or intermediate public transport (IPT) which poses as a significant element of the country's transport networks.

Accordingly, this form of transport is most widely used in many Asian, African, and Latin American cities in the form of taxies. Numerous beneficial features characterise informal public transport. For instance, when compared to formal public transport services, vehicles in informal public transport can be quicker and cheaper as well as more reachable and reliable. However, these vehicles are habitually unregulated, uncontrolled supply-wise, environmentally unfriendly, unsafe, and unaccountable and, therefore, unpredictable. On the other hand, the presence of informal transport systems in these cities illustrates that city management does not sufficiently meet transport needs through formal public transport services. For that reason, the demand and supply gap left by formal transport mechanisms has been bridged through informal transport systems. Also, the informal transport acts as an indispensable source of income for many city dwellers; thus, it forms a significant part of the larger economic/political interests. Also, living standards in many of these developing cities are changing. Growing cities are undergoing economic growth, and the aspirations of the middle class are no longer confined to specific transport services. The middle-class translates higher incomes to mean ownership of bigger cars, better mobility, and better quality of service. Also, in societies that are based on services, the best companies tend to compete for the best human capital. Thus, the quality of life in the workplace is an important aspect of employees when selecting their employer. Consequently, transport access and means become an essential element in standards of living. Corporations are investing and locating themselves in cities or locations with a public transport system with integrated ticketing, multi-modal assimilation, above-average service, and safety provisions, which match the demand for high-quality living standards. It is in this view that the role of informal public transport becomes contentious as it faces the accumulative pressure and competition to upgrade its services and to incorporate the formal public transport system in a healthier way. Based on this reason, there is a necessity to discuss this issue and that there is a guarantee that a city's travel needs are met in a sustainable way. Moreover, this calls for the most right combination of travel modes.

Accordingly, it is on this presumption that this mini-dissertation aims to evaluate the increasing impact of the informal settlements on public transport in South African cities. Further, the mini-dissertation evaluates two aspects that are meant to draw attention to importance in integrated planning systems and that is the land use and the spatial planning. Also, it will highlight the available transport modes, review the economic outcomes of public transport, and recommend a means to remove informal settlements to incorporate an integrated public transport mode. In the past decade, we have seen a growing interest in the integration of transport networks and land-use planning. The integration is founded

on an acknowledgement not only is the land-use affect the transport networks, but that investment in transport also impacts land-use pronouncement.

In theory, this undermines the advantages of capacity development directed toward alleviating urban congestion issues. For this reason, the credit calls for both transport networks and land-use to forge a relationship to have an integrated approach that is utilised for strategic planning of the urban regions. It should be noted that there has been an advancement in the connections between aggregate transport type with the total spatial interaction of land use.

Up to now there has been no behavioural framework developed with the aim of explaining the land-use and travel patterns in an integrated technique. On one hand, it is necessary to understand the interactive links between daily household activity and transport arrangements. Conversely, it is also requirement to know the long-term adoptions of housing, employment, position, and vehicle ownership, which have been deceptive for some time. However, presently, the integrated frameworks are limited in their capacity to offer a right fit pattern when it comes to the development strategies that should fuse both the labour and the housing market with transport response.

This mini- dissertation reviews the crucial dimensions of urban public transport in South African cities. The primary focus is on the relationship between urban form, land use, spatial planning, and public transport manifesting in the form of increased informal settlements in South African cities. Some considerations motivate the focus on informal settlements and public transport. First, South Africa is undergoing rapid urbanisation resulting in “high population growth, which is expected to continue until 2020”(City Mayor Foundation, 2006). This phenomenal urbanisation progression has been linked to significant public transport service constraints and obstacles, in addition to other challenges (Wright, 2003).Specifically, huge deficits have been identified as one key problem area in the stipulation and delivery of quality urban roads and rail networks(McKenzie, 2005).

Accordingly, some analysts have identified such deficiencies as indicators of an urban public transport system failure or crisis. On the other hand, a conflicting intellectual tradition on transport considers this an opportunity in which to implement radical, bold, and transformative transport interventions to reverse the current problem. Consequently, exploring the various challenges facing urban public transport to provide alternative solutions provides fertile ground for policy direction and research (Chakwizira, Bikam, Dayomi, & Adeboyejo, 2011).

This mini-dissertation is an extension of the current debate on the subject of how to best resolve urban transport problems in South African cities.

1.2. Problem Statement

Currently, South Africa is challenged by significant public transport issues that have arisen from increased urban sprawl, which is one of the legacies of apartheid. The racially segregated human settlement policies envisaged a low-density spatial layout that separated living areas under apartheid, leaving the black and the poor to be relegated to townships located on the cities' peripheries. In addition, to segregating races, the apartheid, human settlement policies served to promote inequality in housing, spatial planning, environmental landscapes, and the distribution of public facilities. According to Seekings "Residential segregation (under the Group Areas Act) resulted in towns that were mercilessly divided into separate 'white', 'coloured', 'Indian' and 'African' areas."(Seekings, 2000). After the apartheid regime, the human settlement continued to increase in the peripheral areas of the cities in South Africa, where land is cheaper and easily accessible. While this has been viewed as a more reasonable solution to the rapid population growth problem facing South African cities, it is also a costly approach. Notably, because of the increased peripheral human settlements, the government has been forced to provide operating subsidies for public transport while poor households are forced to use up enormous quantities of their disposable earnings on public transport. Further, the majority of South African cities faces numerous challenges due to increased pressure on public urban infrastructure and services due to urbanisation as well as the fragmentation of households into smaller, more numerous families. Consequently, to meet the demands called for by the public service delivery that are imposed on the cities in South Africa, there is a need to utilise the limited skills that are available in both effectively and efficiently manner.

To this end, land and land-use planning have been identified as key elements in the effective and efficient management of the sustained growth in urban areas, the future of the South African cities, over and above their sustainability, relies on strategic decisions that take into consideration the adequate preparation for growth. As mentioned earlier, the direct result of urban growth is increased pressure on public service delivery, which directly affects various sectors within cities, particularly human settlements and transport. Primarily, the demand for transport anywhere in the world is always propelled by the fundamental need for individuals to access places where activities or events significant to them happen. These activities include work responsibilities at workplaces, education at academic institutions, and health care at clinics and hospitals. It is, for this reason, that efficient land-use planning is crucial. Planning defines and describes the location of the primary facilities for human settlements. While subsequently determining how far individuals are required to travel to access such services and the amount of money households and the government must spend on transport. Further, distortions and inefficiencies in the "spatial structure of cities and towns inflict direct costs on individuals, households, and businesses" (Alain Bertaud, 2010).

Alain states:

> "[T]he abnormally high consumption of residential land in South Africa's large metropolises is not a trivial matter. The current spatial structure of South African cities is partially responsible for; increased income gaps between the poor who cannot afford the mobility required in large cities and the middle and higher income groups who are fully mobile and can take advantage of increased productivity."

Today in South Africa the housing and public transport sectors and land-use patterns come across various challenges. For instance, the existing system of public transport is ineffective, insufficient, expensive, and inaccessible, and simultaneous coordination is non-existent between transport planning and land-use patterns. Further, rising levels of urbanisation and poverty have amplified the demand for housing (particularly in cities), which has subsequently influenced human settlements. Also, other public transports and housing challenges are directly linked to the modelling of South African urban settlements by the apartheid rule. This has given rise to the spatial separation of housing areas on social class and racial grounds subsequently promoting social isolation. For instance, road systems created during the apartheid regime, which continue today, were designed for use by motor vehicles. Contrastingly, many other world cities that have higher densities ensure that their road systems have allowances for pedestrians, buses, and cyclists. Also, in urban areas, there is an increased demand for housing as well as appropriate land on which to build houses. Additionally, the well-located and suitable land is expensive, limited, and in some areas, not the government -owned. As a result, the majority of projects that are targeted at providing housing for the disadvantaged communities are subject to be located in the outer surrounding regions of the city. The land in these areas is readily obtainable, cheaper, and easily accessible. The regions within inner cities pose a problem as the land in these areas is not readily available, what this means is that efficient and effective strategies need to be employed once the land is made available.

In summary, three critical issues that emerge from urban form and density in the South African context. First, the overall densities in South African cities are extremely low (at 2,960 people/km2) according to international levels "(currently estimated at 8,292 people/km2 in low- and middle-income countries and 3,100 people/km2 in high-income countries)". This has now resulted in increased infrastructure provision costs, ineffective logistic networks, long and expensive travel for people, and declined market thresholds. Next, the density gradient in South African cities is often inverted, that is, the highest city densities are located in sections of poor earning communities or informal settlements in the peripheral areas. Instead, of them found in areas closer to urban areas. Lastly, spatial fragmentation of the labour market due to distorted urban form also scatters available work (Bertaud, 2008).

1.3. The purpose of the Study

The purpose of this mini-dissertation is to investigate the issues of human settlement and public transport in South African cities. This is with the understanding that the apartheid city planning policies generated fragmented communities and in this manner, distorted the implementation and sustainability of comprehensive transport interventions. For instance, the informal residential areas, where the bulk of poor/low-income public transport communities reside, are situated far from urban and commerce areas. As a result, these populations incur significant transport problems in their quest to utilise and access socioeconomic opportunities and facilities within the cities. This mini-dissertation seeks to investigate the relationship between increased informal settlements in peri-urban areas of South African cities and public transport to (or "intending to") understanding the impact of urban form on mass public transport.

1.4. The objectives of the Study

The key aim of the mini-dissertation is to examine the effects of the increasing number of informal settlements in the cities in South Africa on public transport. However, to achieve this goal, the mini-dissertation explored a variety of issues associated with areas of human settlement and public transport. The specific research objectives include:

- Land-use patterns and their effect on public transport,
- Spatial planning and public transport, and
- Economic outcomes from public transport.

2. CHAPTER TWO: BACKGROUND OF THE STUDY

2.1. Introduction

This chapter is sectioned into two main parts aimed at developing a sufficient background for the current study. The first section of this chapter explores the concept of human settlements and poverty, which leads to a discussion of the phenomenon of informal settlements in the cities of South Africa, their nature, and factors for growth. The second section of this chapter is dedicated to understanding public transport in South African cities.

2.2 Human Settlements and Poverty

The poverty that is often regarded as an income shortage, which in turn gives rise to various forms of deprivation as well as the inability to meet the expenses of necessities and goods. As a result, individuals may be marginalised and excluded from taking part in activities or events considered the norm among societies. According to Pomeroy and Evans (2008), housing is a vital element and a tool for formulating policies and implementing programmes in poverty alleviation. Notably, while housing is just one issue among the various needs of individuals in life, it is also the first and highest expenditure of all personal necessities. As such, analysts advanced the notion of a housing-induced poverty that can be intensified by a variety of factors, including increases in housing interest rates and costs. Many countries in the world often focus their poverty alleviation efforts on the direct problems of urbanisation. For instance, creating employment, accommodation of the poor, and improving living conditions as well as advancing administration and governance of progressively complex systems. However, while these issues are crucial to poverty alleviation, they tend to shrink when compared to the problems associated with a growing urban population. Consequently, rather than merely responding, cities need to conduct proactive and to plan for urban growth and its connected challenges. Primarily, to confront the extremely controversial problem of human settlements, analysts, and planners need to understand that delivering housing extends beyond the mere provision of shelter. Specifically, the housing consists of infrastructure and other services that are essential to ensure that human settlements or housing are habitable. Indeed, the standard of living of any housing condition is reliant on the accessibility and availability of amenities, including hospitals, schools, sporting facilities, and police stations. Additionally, convenient, safe, and affordable public transport is central to human settlements to enable individuals to move from their residential areas to work or other facilities.

2.3. Informal Settlements in South Africa

There is no widely accepted definition of informal settlements. Informal settlements are also known as shantytowns, backyard shacks, slum areas, or squatter settlements and are densely populated settlements with units made from makeshift material as a form of shelter in the land that either illegally occupies that is not zoned correctly.

The UN-Habitat defines informal settlements in two categories including:

“(a) Squatter settlements, which are defined as settlements where land and buildings are occupied without the legal permission of the owner.”

“(b) Illegal land development signifies as settlements in which initially occupied is legitimate, but where unofficial land developments and settlements have ensued.”

For instance “breaching zoning plans through land- use changes, land subdivisions while ignoring provisions for services and infrastructure, building extensions without building permit, et cetera.)” (UN Habitat, 2003).

Informal settlements are considered temporary though real, alternative shelter provision, poor occupancy of the city that is unable to access formal and mainstream housing.

Consequently, these settlements feature “a dense proliferation of small, makeshift shelters built from diverse materials, degradation of the local ecosystem, and severe social problems”. These Shantytowns emerges from the existing land planning and administration systems fail to cater to the requirements of the entire society.

The categorisation of settlements it is according to illegality and informality. They are rapid and do not form part of the city's planning. (Godehart and Vaughan, 2008). They present environmental hazards, poverty, vulnerability, and social stress, among others (Godehart & Vaughan, 2008). Globally, informal settlements or shantytowns have become a significant problem, particularly in third world countries, where these areas provide and give shelter to the majority of poor and disadvantaged communities. In South Africa, informal settlements have increased exponentially in recent years and have been characterised as eyesores in the majority of major cities in the country.

Also referred to as ‘mukhukhu’ these areas are a desperate requirement for shelter the disadvantaged city dwellers. The informal settlements in South African cities are made up of non-conventional housing structures erected without compliance with the existing legal building procedures. Further, these shantytowns are usually built and developed in the peripheral areas of the cities, where land is neglected, readily available, and relatively cheap (Moser & Satterthwaite, 2008). Houses in these settlements are usually built using salvaged materials like tin, wood, and corrugated iron, among other materials. Further, these informal dwellings mainly lack proper indoor amenities, including sanitation, water supply, drainage, and waste disposal as well as good road access. Also, informal settlements often vary in their social composition, partially because they are established to serve different purposes. For instance, they may develop because of their location about jobs, or the relative availability of schools, houses, health facilities, or other facilities (Turok, 2010). Similar to other governments in parts of the

world, it is evident that the South African government has been unsuccessful in ensuring that rapid urban growth is supplemented by investments in public services predominantly in indigent settlements. As a result, the number of households residing in informal settlements in abject poverty and without suitable infrastructure has increased significantly in the last decade. Poverty in shanty towns extends further than the mere lack of employment or income. Primarily, it is characterised by the overcrowded housing, declining nutrition, and health rates. There is an increase in school dropouts and augmented stress on the social and physical environments of poor urban residents. Further, the dreadful state of shantytowns in South African cities is often increased by limitations of land costs that are inappropriate for accommodating low-income and urban poor groups (Huchzermeyer, 2006). Accordingly, due to the lack of housing and affordable land, the majority of the urban poor, including migrants, are forced to construct their houses in shanty towns. This is in an attempt to solve housing problems on their own (Yuen, 2007). It is extremely challenging to find consistent and accurate figures for the informal settlement surfeit in South Africa. Currently, the South African government estimates that there are 2,700 informal settlements throughout the country, made up of approximately 1.2 million households, with another 0.6 million homes in backyard shacks. On one hand, according to Statistics South Africa (Stats SA) in 2009, approximately 1.5 million individuals were living in informal settlements in cities across South Africa. On the other hand, Stats SA (2009) maintains that statistics of households living in informal settlements and traditional dwellings declined from 26% in 2001 to 24% in 2009. In the meantime, three out of the nine Provinces in South African have higher numbers of families residing in informal settlements. For instance: Gauteng has 22.7%, North West has 23.8%, Free State has 18.4%, Whereas KwaZulu-Natal at 8.6%, Limpopo at 5.6%, Eastern Cape at (8%) which reported the lowest percentages of households living in informal dwellings (Tshikotshi, 2009). Contrastingly, the estimation of the actual quantity of people housed inefficiently in South Africa is conceivably higher (i.e., more than 1.5 million). This is in comparison to estimates provided by Stats SA (Misselhorn, 2008 as cited in Tshikotshi, 2009). According to Misselhorn statistics of physical informal settlements, are often used as criteria for counting, instead of the actual figures for families that may reside in a single informal unit.

Accordingly, Stats SA (2007) estimated that approximately 65,113 families were living in informal settlements in Cape Town in the year 2004. The City of Cape Town contends that there were approximately 94,972 households (Misselhorn, 2008, as cited in Tshikotshi, 2009).

Further, Stats SA does not take into consideration the high numbers of illegal migrants from neighbouring states, such as Mozambique and Zimbabwe, into South Africa. Notably, a significant number of people from this process may also increase the quantity of households living in informal settlements to approximately four million families. It is also challenging to count foreign nationals living in these areas since they are often apprehensive of expatriation (Stats SA, 2007). Further, Misselhorn (2008, cited in Tshikotshi, 2009) maintains that, contrary to the statistics provided by Stats SA, that there has been no prompt drop in the figure for families living in informal settlements in the recent past. This is restated by

the South African Department of Housing (2009), which estimates the housing backlog of approximately 2.2 million units and concludes that the backlog is indeed increasing. Ironically, this is despite an impressive low-cost housing provision of about “2.8 million houses in a period of 14 years” (Rust, 2008). According to Turok (2010), such discrepancies in the figure of informal settlements in South Africa occur because of lack of consistency in the explanation of an informal settlement. Besides, it also appears that there is insufficient recognition of the diversity that exists in these areas, coupled with a minimal understanding of the role these areas perform within the urban labour/housing market system. Arguably, the informal settlements in South Africa play a crucial economic role. Residents of these settlements regularly function as a labour pool that adds to the overall economic growth of the city in which they exist and the country as a whole. Notably, the city economy depends heavily on the cheap labour provided by the urban poor. The "urban poor households support the formal economy since they do not demand huge quantities of capital in regards to housing and associated services” (Aldrich and Sandhu, 1995). Also, Mncwango (2005) also speaks of the value of informal settlements in supplying the urban poor with cheap and accessible accommodation (Mncwango, 2005).

Gobodo (2008) further points out that the informal settlements are where individuals live, procreate, and recreate. For several others, informal settlements are also where they earn a living. Additionally, a small number of people would readily volunteer to reside in informal settlements if they were able to afford or access formal brick and mortar structures (Gobodo, 2008). Kapoor et al. (2004) affirm that poor urban households choose to live in areas that are close to their work or employment sources. Also and in societies that are comprised of individuals with shared socio-demographic characteristics.

2.3.1. Causes of Increased Informal Settlements in South African Cities

Extensive literature shows that there are various reasons for the formation or development of informal settlements, even though the implications of these settlements are relatively analogous. Indeed, it is clear that informal settlements develop when the existing land planning and administration systems are incapable of catering to the housing needs of the entire community. As such, when these systems fail to satisfy increasing social housing needs, individuals seek other alternatives in the form of shanty towns or settling other people’s land to address their housing needs. As a result, such unauthorised settlements tend to feature rapid, exponential, unplanned, and unstructured development. Some of the causes of the increased development of informal settlements in South Africa include population growth, rapid urbanisation of cities, and failure of governance as well as institutional or legal failures.

2.3.2. Rapid Urbanisation and Population Growth

Almost a century ago, the urban population accounted only for 4% of all the people in the world. However, today cities across the world are home to more than half of the world’s population. Notably, the rapid and exponential increase in the number of urban dwellers in cities (especially in developing

countries) experienced in the past several decades been attributed to both migration and natural increase. Native population progressions and augmented rural migration to the cities in developing nations have by far surpassed the existing and accessible housing facilities in the cities for both the middle and low-income residents. On their part, municipal authorities have been incapable of solving and adequately addressing such problems based on the increased demand for land by urban communities. Consequently, various categories of squatter settlements have developed on unoccupied lands within central cities and on the peripheries of the main cities. The research on the global trends in the population illustrates the exponential growth of populations within cities that will continue to increase and subsequently, the housing demand in urban areas will also increase with the same trend and pace. In South Africa today, more people are residing in urban areas than living in cities than rural areas. Projections indicate that South African urban population is growing at approximately 58% per annum. As a result of this rapid increase, the majority of poor urban households resides in impoverished and insecure conditions. In the meanwhile cities and towns have been unable to respond sufficiently to the rising demands of urban growth (DoH, 2009). According to Mahanga (2002), necessary infrastructure, public services (including accessibility to cities), and water supply are in an unfavourable condition. Similarly, unemployment, overcrowded housing, and urban poverty have also increased at a rate that matches that of urban population growth. Importantly, it should be noted that the majority of the people who live in informal settlements migrate to cities and towns from rural areas to escape from poverty. This is to pursue relative progress among the supposed optimism of cosmopolitan prospects. Primarily, immigrants are attracted to cities by the perception of better socioeconomic settings, such as the significant rural-urban gap in living standards as compared to the collectivisation system in rural areas. As a key pull factor, better or increased access to socioeconomic opportunities has led to the creation as well as the permanence of informal settlements in South Africa. Also, according to Cross (2010), the majority of urban shack areas plays a vital role in reception gateways or regions for immigrant populations. They provide inexpensive entry points to attaining a foothold in the urban labour market. This is a financial attainable, the inexpensive area of the city that they can pursue employment opportunities (Cross, 2010). Strangely, these migrants are unable to prosper in the cities or towns since the majority lack the required job skills and education, as well as decent housing. As a result, they regularly “become victims of the city’s wrath” and “they pose a daunting problem for policymakers in the developing world” (Atuahene, 2004, p. 1110). The bottom line is that migrants often end up living in “socially, economically, and politically marginalised urban communities referred to as informal settlements” (Atuahene, 2004, p. 1110). Also, the skills deficiency impacts the means for them to sustain their livelihoods. The lifting of apartheid restrictions by the post-apartheid South African state resulted in the declaration and implementation of a new urban policy. Subsequently, legislation, such as the Constitution of 1996, Housing White Paper of 1994, Housing Act of 1997, and BNG of 2004 among others, were fundamentally passed to recompense for the inequalities that were caused by the apartheid legacy. Consequentially, South African cities have been experiencing increased population growth, densities, deteriorating the

environmental quality, congestion, and the rising cost of urban services. “Migration to urban cities and internal growth of cities exceeded by far the creation of jobs” (Godehart & Vaughan, 2008, p. 10). However, according to Turok (2012), as a direct consequence of settlement patterns, colonial and apartheid policies have left a daunting legacy. This includes a fragmented, distorted and urban form with unequal access to jobs, amenities and public services. The post-apartheid government has not been able to alleviate this legacy due to “the durability of the built form, the power of vested interests, persistent income inequalities between races, and lack of upward mobility.” (Turok, 2012).

2.4. Transport in South African Cities

2.4.1. The utilisation and demand in South Africa of Public transport

In the South African context, similar to other areas in the world, the utilisation and application of Public transport fundamentally determined by the individual requirements to access areas where significant events or activities occur. These are activities such as employment stations, hospitals, and schools, among (National Household Travel Survey, 2003). According to the Department of Transport (DoT) in its National Household Travel Survey carried out in 2003, the primary purpose of using public transport among South Africans is to access educational institutions. Shopping and accessing malls are the second reason for the use of transport (especially metros), as an outcome of the distorted traditional land-use patterns whereby commercial centres are located far from residential areas. Further, it is estimated that approximately ten million urban residents use public transport systems across South African cities (Development Bank of Southern Africa (DBSA), 2007). The primary form of public transport preferred for these purposes is taxis, which account for sixty-three percent of all the trips made daily. The other modes of transport used, such as the bus and rail, account for the remaining 22% and 15%, respectively. Monthly spending for these modes of public transport is R222 for taxis, R201 for buses, and R172 for the train (Stats SA, 2007). According to the DoT (2003): the affordability of public transport is a core issue in urban populations with the majority of urban home spend a fifth or more of their monthly wages (DoT, 2003) on transport. This is despite the fact that the state subsidies both bus and train transport. According to the survey, the majority of public transport users prefers to use taxis since they are faster compared to other forms of transport, and an individual can cover shorter distances to access taxis. Comment [BK9]: Note that while transportation and transport are the same, transport is used in UK English, and transportation is used in US English. Either way, the term should be consistent throughout, so instances of transportation were changed to transport for consistency.

2.4.2. Management of Public Transport

In the National Land Transport Act (Act 5 of 2009): Public transport in South Africa is collectively managed by the national, provincial, and local government departments. Specifically, the National Department of Transport is in charge of the formulation and monitoring of overall transport policies as well

as management of national transport related funds. The National Department of Transport works in conjunction with other national government departments. These include the Department of Trade and Industry, the Department of Energy, and the Department of Labour, to formulate and monitor policies that impact public transport in the country. On their part, provincial departments of transport are tasked with the responsibility of implementing and managing transport infrastructure. The responsibilities include provincial roads, refining the national transport policy to suit provincial settings, coordinating transport activities within provincial borders. Also providing a variety of transport-related administrative functions, including public transport operator licencing and transport subsidies. A large share of the administrative duties executed by provincial transportation departments is also decentralised to the local government, particularly in large metropolitan areas. Subsequently, the local governments operate at grassroots transport policy implementation proxies this is through transport planning as well as systems and infrastructure projects and programmes. Local governments accomplish the application of national transport policy through Integrated Transport Plans (ITPs) that (in addition to other functions) priorities the enactment of projects and programmes in municipalities. The ITPs are reviewed annually through public participation processes. Officially, no city or local government can implement any transport plan if they are not included and described in the ITP. The Integrated Transport Plans were adopted officially as transport implementation and management tools after the induction of the National Land Transport Transition Act (Act 22 of 2000). This was revised in the National Land Transport Act (Act 5 of 2009). The National Land Transport Act came about as an outcome of a national revolutionary transport reform policy encapsulated in the 1996 White Paper on National Transport Policy. The primary objective of the white paper was to metamorphose land transport across South Africa with the ultimate goal of dismantling the inefficient apartheid transport legacy, as well as orienting transport investments towards public transport. Even though an improving transport policy has been put in place, there are still numerous shortcomings in the sector of transportation, which require strict and rapid interventions in South Africa. The first shortcoming is vested interests. Whereas vested interests are inevitable in economic sectors characterised by multiple stakeholder needs like the transport industry, it is imperative for the relevant parties to ensure that such interests do not affect or impede overall progress. A good example of such stakes is the resistance to transformation arising from Transport and Allied Workers labour unions, Operators in the public transport sector and state-owned public transport operations. The second shortcoming is the failure to integrate modes of transport. Specifically, the South African government has been unable to implement any sustainable examples of modal integration to date. Third, the transport sector features travel a long distance and time, whereby the time spent travelling using public transport in South Africa is significantly higher compared to private transport. This has been attributed to a blend of two factors, including

- Comparatively distant spatial separation of co-dependent land uses, and
- Public transport operations that occur in mixed traffic.

Notably, this situation is more critical in rural areas because of their dispersed settlement patterns as well as remote locations. The fourth shortcoming is design standards that favour car use in South Africa with minimal attention to multimodal user needs. Fifth, the transport sector is characterised by inadequate monitoring mechanisms whereby there are no systematic and institutionalised transport policy control mechanisms. Lastly, public transport in South Africa mainly considers the mood for poor and low-income populations. Pointedly, public transport in the country has yet to attract potential users across the various South African demographics through enhanced service and marketing design.

2.5. Summary

This chapter has discussed the nature of informal settlements and the South Africa's Public transport dynamics. During the discussion, informal settlements have become home to more than 1.5 million low-income households in South Africa today, mainly because they offer cheap and secure access to land and housing. The increase has been attributed to rapid urbanisation since the majority of informal settlement functions as reception areas or gateways through which migrant populations and the urban poor can access the urban labour market. Transportation demand in South African cities is driven by the need for individuals to access areas where significant events or activities occur, such as employment stations, hospitals, and schools, among others.

3. CHAPTER THREE: LAND USE AND URBAN PUBLIC TRANSPORTATION

3.1. Land Use

In the recent past, future urban planning has been the subject of extensive deliberation. These considerations have emerged since, in the past, urban planning was perceived to be an ineffective instrument, which was unqualified to address urban development efficiently. Recently renewed consideration for urban planning has emerged. Consequently, there has been a shift from the initial perception of a more ambitious order and control of the city. Accordingly, planners have started re-evaluating themselves in the new framework of modern urbanisation. Countless cities around the world have become synonymous with informal settlement formation in the global economic crisis. Therefore, it is necessary that urban planning members should recognise the changes mentioned above, in addition to developing new methodologies to handle challenges facing urban development. For that reason, the land is the most significant resource for urban development. From the definition, the land is a limited resource that is to be maintained and managed throughout its usage. Successively, intensifying the human necessities with financially viable undertakings that have increasingly placed pressure on land resources, resulting in increasing competition and constant conflicts, as well as the minimal land and its resources. It is on this platform that urban planners have realised that the sustainability of human needs in the future is to be fulfilled.

Also, it is the time to resolve such fundamentally as "the efficient use of land and its natural resources" (Unep.org, 2016) and others such as the resolving and advancement of an operatively advanced approach.

In this mini-dissertation, the primary goal is to assess the impact on public transport by the increased rate of South Africa's informal settlements in the cities. Accordingly, the mini-dissertation will determine the following:

- The importance of land-use about spatial planning to highlight the importance of integrated planning systems,
- The existing transport modes that are available in South Africa,
- The current economic outcomes of public transport, and

The instruction of public transport to serve as an aid in the process of the remove informal settlement.

3.2. The demand modelling and the history of city travel

Urban planners and scholars for many years have recognised the significance of travel modelling. The planners over the years have relied on several methods of establishing the flow of travel and also means to spatial travel appraisal. Also, in the 1950s, the growth and strategies to conduct demand transport

assessment saw a collective move towards what is referred to as a the four-step model" (McNally, 2007) and (Sivakumar, 2007) and another method that can be used is the ring theory.

A moderately disaggregated version of the "four-step model" (McNally, 2007) and (Sivakumar, 2007) is practised by numerous city planning organisations globally. An expansion of the "four-step model" comparatively acknowledges the complexity of the link between the transport systems and other urban systems.

3.3. The integrated strategies for land use planning

The planning and management of Land-use in corroboration with integrated physical planning defines an exceedingly practical way to achieve operational and efficient use of land and land natural resources. Therefore, through the examination of all land uses in an integrated method, it becomes potentially possible to reduce conflict. To ensure that this is an achievable trade-off and social connections that primarily responsible for the protection of the environment and financially beneficiary to society entirely. The project objectives should be sustainable over time. For that reason, the spirit of the integrated method discovers manifestation in the synchronisation of existing sectoral planning and administration activities that are linked to numerous features of land usage and land resources. Additionally, the method employed that are integrated into resource planning and management of land handles the restructuring and the reinforcement of decision-making designs, such as current policies, planning and management techniques and approaches to land resources. Land resources have numerous uses that may interact or compete. For this reason, it is necessary to plan and to administer these utilizations through an integrated method.

In most instances, integration should take place on two levels with consideration of the environmental, social, and economic factors that impact both the macro and micro economy segments of the regions surrounding. Subsequently, the other level entails all environmental and resource constituents combined, which are air, water, land, ecological and natural resources. As previously mentioned, an integrated reflection enables the most suitable choices and trade-offs. Hence, it facilitates the maximisation of sustainable land productivity and usage. Consequently, the opportunities to apportion the area for different application crops up as a course of the principal settlements and in development ventures or due to sequences arising when land turn out to be available on the market. Numerous techniques, structures and strategies are adopted to pull together in approaching integration in maintaining the sustainable patterns in land management. These also ensure that there is a preservation approach in the safeguarding of the environment. As such, both at national and provincial levels the complete incorporation of planning and organisation that of such in the particular development strategies should encourage. However, even though most of the elements of the integrated approach are already in place, there is a need to stress their implementation and application. The broad objective should be directed at

the facilitation of allocating land to numerous uses. However, the allocation must observe the order of sustainable benefits. Further, the allocation must aim to safeguard the land resources in as far as the evolution of the into a more integrated and sustained execution. Due to this, all existing social, ecological and economic concerns will be appropriately addressed. By this, it entails that the population, the native dweller's rights, property rights of private land and other practices, among other issues, will be considered and accorded due attention.

Hence, in more exact footing, the objectives comprise of:

- The development and the strengthening strategies in the planning and assessment of the land resources about most excellent, efficient usage of land and the sustainability thereof.
- Develop guiding principles that seek to uphold up the sustainability of land resources
- Reinforce institutions and organising structures for land and land resources,
- Fashion mechanisms to enable active participation and involvement of all concerned stakeholders, especially those affected most (communities and locals) in the decision-making on land use and its management.

3.4. Travel demand models

3.4.1. Travel demand "aggregate Models."

These are straightforward mathematical models that were earlier adopted to estimate travel requirements that had a compromising effect on calculating demand because the use the region size. This model is a fundamental aggregated trip-based model. It translates to the number of trips that are appealing to give area to have a relationship with the desirable attraction in the regions. Also, the transport from area to area and was found not to be related to the travelled distances amid these regions.

3.4.2. Disaggregate Trip-based Models

Development of modelling methods shifted away from collective modes and resulted in the expansion of disaggregate type models.

Accordingly, the studied area together with the residents travel that is disaggregated from region to region is controlled and optimised.

In contrast to the aggregated travel demand model, the disaggregated model looks at the sole household unit in making decisions on the travel patterns. Moreover, it considers the impact brought by unique social-demographic features that are linked to transport selection.

Nevertheless, there is limitation produced by the model, based on the fact that there is a lack of information, in reality, the model is applied as in the same form as the aggregated model. Accordingly, regardless in the shift and advancement in the disaggregated methodology, they still present and demonstrate numerous severe restrictions.

For instance, the significant disapproved limitation is the reality that the lack of the reflection of trip connections. The door to door trip from the house to the place of employment, travel is analysed as an independent return trip. Therefore, these trips are categorised as home to work travel.

The outcome with travel models could, in theory, be apportioned to the diverse travel modes. Be, that is it a return trip from home to work trip. As such, the establishment of the tour-based models was to tackle these limitations.

3.4.3. Tour-based Models

Many transport demand models are presently operating using a tour-based, four- step modelling methodology. As such, this method splits all single trips and address them as tours. These trips could be a home or other node points. The tour based travel may include not only home to work but will take into consideration like travels other services or attraction like the shopping, amenity and place where people can conduct the errands. Therefore, "all other non-home established trips, such as a journey from the workplace to lunch, or from one shopping place to another, or a business trip from work, are classified under two purposes. These are namely, the non-home-based employer's enterprise and non-home based other. Within the four-step modelling framework, the occurrence of these tours and trips is first projected (known as the tour generation step)". Characteristically, the most advanced method is when the model combines both the trip distribution and the selection of the travel mode. Whereby type of travel mode is factored into the choice of mode together with the time travel. Lastly, the travel system process is obliged to apportion the travel tours. Even though popular in practice, the tour-based models remain limited. These models lack behavioural practicality on several counts, and these limitations are similar to those on the travel-based approach.

Features of the tour-based models are: Number one, there is no link between trips and as such are independent travels. Two, some trips are not considered that are necessary to the passengers for instances the dropping off the children to school along the route. Three, they lack in giving attention to looming trade-offs across transport options. For example, individuals with limited time at their disposal may resolve not to utilise that time to dine out at that time. Four, they fail to take into account the impact of household relations towards travel.

Lastly, they fail to deliberate on the effects that in-home event on travel. Also, they are strategically inadequacy when it comes to behavioural convincing.

3.4 .4. Activity-based Travel

In essence, “the remedy for the limitations of the trip and tour-based methodologies are the activity-based pattern” (Bhat & Sivakuma, 2003).

Accordingly, activity-based models recognise that transport requirements are coming from the activity needs. These activities are periodically based are they are limited by the time and space. To accurately quantify a population’s travel requirements, it is imperative to model the activity/travel arrangements of that population. Further, the people fail to recognise that interactions amongst individual are essential does limit the model. Thus, the activity-travel arrangement of a person is driven by the transport of other people that will interact with them within the same population. Presently, activity-based models that are effectively applied are limited including the “the Albatross model” (Arentze & Timmermans, 2004).

Many activities- based modelling systems, such as the BB System, “are either centred on a system of econometric models, or are computational process models that are focused on a system of rules and heuristics” (a good example is Albatross) (Algers, Eliasson, & Mattsson, 2005).

3.5. The pioneers in bringing change to our transport ecosystem

Generally, amongst scholars and planners demonstrates that the aspects that are triggered when it comes to the transport network improvements, These are, namely: a rise in population growth urbanisation expansion, globalisation, and technological advancement.

3.5.1 Growth in the population

Largely, the leading cause of the transport system overcrowding, especially in more urban settings ever for increasing population densities. For example, in the past decades, the population growth in South Africa has increased to the present 51.19 million people.

3.5.2. Hyper-Urbanisation

The difficulties induced when trying to meet transport requirements of highly populated cities, as well as modern-day arrangements of communities, such as slums, require a modern and integrated transport network. Considering the physical growth restrictions of cities across South Africa, it is clear that growth is reflected in two ways—mega cities and compound communities or gated communities. Further, existing research estimates that by the year 2020, developing economies will host the majority of the world’s mega-cities so that they can accommodate their rapid population growth. For example, the demarcation lines between Johannesburg and Pretoria rapidly narrowing as a result of urban expansion leading to the unity of both to make up a major city.

Accordingly, the present transport infrastructures affixed predominantly to roads are mostly insufficient to provide mobility for both goods and the inhabitants in these two major cities effectively. In looking at another example, the prediction is that cities around the world that have a high-density ratio per square area, for instance, New Delhi in India, Sao Paulo to name a few can only expand by developing compound communities. Accordingly, this will only require a transport system for short-distance travel, personal mobility, and delivery of essential commodities: However, such requirements are not accommodated by current transport systems. This is the case for most South African cities.

3.5.3. Globalisation

The concept of a flattening world is the blurring of different country boundaries, the unity linking policies, sharing of currencies and a move to a more borderless nation have impacted the world both negatively and positively. (Friedman, 2005).

Therefore, globalisation of transport creates an increase in traffic from all types of transport between urban centres, demand for greater travel speed, and demand for security and reliability of the transport mechanism. The next evolution of the transport ecosystem stresses that the delivery of something or someone from point A to point B, and vice versa must be of a high service level. This is despite the distance, borders crossed, or the number of steps/stopovers connecting the two points.

3.5.4. “Pervasive Information and Communications Technology.”

According to Frost and Sullivan, the four principal modes of transport (road, rail, air, and water) have technologically advanced. Equally, the rapid increase of technology in all aspects of communities lives yield shift in the global network. For instance, transmitting the data gathered for processing and analysis stations can improve proficiencies of the existing system and position digital groundwork for different infrastructures. Ranging “from infotainment, trailing, and telematics software for vehicles, to instantaneous scheduling and notification for air travellers, and security monitoring and threat detection for shipping containers, information and communications technology is a high catalyst in an evolving transport ecosystem” (Frost & Sullivan, 2012). It follows that future transport systems require the availability of adequate adaptations for instructional changes. These instructional changes are being experienced in the core areas mentioned above, and at the same time work towards minimising inefficiencies in today’s systems.

3.6.5 Ring Theory

The ring theory model is used in South Africa, it was developed in Europe and needs adaptation in the South African context. The model is that the closer one lives or works to a transport hub, the likelihood that they will use the mode of travel. The trip generation is higher in the primary influence area, 1 km from

the transportation hub, and lower in the influential secondary area, between 1 and 2 km. Trip generation factors regarding trips per capita and per job are derived and applied to the future estimated number of residents and employment within the 1 and 2 km radius from the proposed transport hub.

Transport hub influence demand, such as speed and frequency, and factors are applied to increase the trip generation due to increased levels of service. In the case of rail, the feeder and distribution services to rail will also increase trip generation.

Further, the Ring model technique is calibrated by using multiple regression analyses like population census data. A relationship is obtained between trips generated and attracted node point and population and employment within 1 and 2 km from the existing transport hub. The best regression model thus derived and can be applied accordingly to the area.

3.6.6 Drives of demand for transport

After exploring the number of models that can be used in the transport system application and the as a backbone provide a means to ease the growth of informal settlement through public transport provision. The following drivers are briefly discussed to understand their influence and contribution to the mini-dissertation.

Before considering the potential drivers of change that could affect the busiest public transport corridors, it is useful to review the strategic spatial objectives that will help to shape future housing and economic growth.

The promotion of use land densification to utilise resources more efficiently, including trends towards higher-density cluster or affordable residential development based on densities of 25 to 40 units/ha (net). It may be possible to increase further the intensity of urban development over time as urbanisation and population increases occur;

The integration of economically disadvantaged communities into the urban system, particularly those on the periphery of the system; The promotion of viable public transport systems to reduce reliance on private cars, supported by a hierarchy of nodes to help improve linkages and connectivity. Public Mass Transit systems should contribute to accommodate urbanisation trends and help shape more economically efficient spatial patterns, with feeder services developed to widen the potential catchments. The horizontal spatial extent of the urban system is kept tight and an urban edge is placed on outward sprawl. The intensity of urban development and the densities at which people are accommodated within the urban area are increased significantly through time as population increases. The other potential drivers of change, in addition to the land use and economic factors described above, there are a number

of other issues that can influence future demands: Improvement of the public transport reliability, improve on the journey times, the fuel price that directly impacts public transport.

Lastly the urban subsystem, organisations are constructed, expanded, and relocated, creating new jobs and affecting jobs. Family units are shaped; they grow or decline, and finally dissolve. Each stage in this life cycle necessitates a change in the locality and motorization for fluctuating needs, which determines the distribution of the inhabitants,

3.7. Chapter Summary

On this note, the prediction of the impact of policies that relate to the integration of both land and public transport is a complex process due to simultaneous implementation of transformation on each system. Three streams of these techniques exist that are practicable when predicting these impacts. The first one is stating a preference, which involves the questioning of people regarding their projected reaction to variations that may include transportation cost and the limitation that may be put in on land. The second stream revealed a preference, which is the possibility of depicting deductions from the empirically witnessed behaviour of people. The third stream is the involvement of attitudes that embrace mathematical models with the objective of simulating human decision-making processes, in addition to possible results.

The demand model helped to bridge the gap that the above streams lack to fulfil; the models are practical in demand forecasting of unknown and regulated scenarios. It also significant spatial planning considers all the land use categories that relevantly integrate both urban land use and the used transport models in practice.

This type of spatial pattern will highlight the importance of delivering improved travel connectivity. Also, more convenient modal integration will be essential to connect the transport hubs with these development sites other travel choices to widen the catchment. Moreover, presently there are several practical transport models integrated with land use. Likewise, there are significant differences amongst the models regarding inclusiveness, model arrangement, theoretical practicalities, modelling practices, dynamics, data needs, standardisation, and justification. (Wegener, 2004).

More so, notwithstanding the accomplishments in developing these models, there are numerous challenges. For example, the transport sub-models applied in most modern land-use transport models fail to use modern “activity-based modelling” practices. However, they use the “four-step travel demand model” arrangement that lacks behavioural modelling to react to vast existing practical trip demand strategies. For this effort, the most favourable method is the activity-based demand model coupled with the microscopic travel simulation because they make it possible for replication of travel behaviours of patrons that are multifaceted and in an interactive foundation.

Additionally, there is still huddle it the implementation models on the land use and the transport due to the simultaneous changes that need to be considered. Also, there will be a future need where model structuring will significantly be required to pose spatial fairness and socioeconomic characteristics that are of equal importance. (Wegener, 2004)

4. CHAPTER FOUR: SPATIAL PLANNING

4.1. Spatial planning

Spatial planning, as explained by Cullingworth and Nadin (2006), is an instrument for instituting long-term, sustainable structures for societal, regional, and the inter-Provincial and outside commercial development

Primarily, it is the integration of the spatial planning and commercial separation such as housing, public transport, provision of electricity and workplaces. It also cultivates the advancement of the National and Provisional frameworks in the rural and metropolitan developments that are environmentally conscious. (Cullingworth & Nadin, 2006).

Accordingly, scholars in the field suggests are made to policy makers to acknowledge the importance of spatial planning, especially in urban land areas. Also, the role of spatial planning is to raise awareness to the communities about the significance of social cohesion before initiating any projects. Last, spatial planning ensures that all concerned stakeholders in territorial development, such as housing and human settlement, including related policies and environmental protection policies, are consulted and adequately considered (UN HABITAT, 2005). In reality, cities in developing countries face acute problems of poverty, segregation, insecurity, and the environmental dilapidation. In fact, the emerging countries are faced with the issues of the increasing gap in wealth between the affluent and the poor people. This is evident in their city's characteristics that are segregated, lack security with no conscience of the environment. This gap translates into ever- increasing differences in the quality of life between the two groups. For instance, in South Africa, the affluent dwell in leafy suburbs, while the majority of the poor live in the townships like Soweto. Accordingly, the most notable characteristic of housing for the two classes in urban forms is that fashionable security estates and gated communities are developed in the proximity of the dilapidated neighbourhoods and slums.(Brebbia, 2013).

According to research conducted by the UN (2008), “accurate urban planning is a fundamental factor in bridging the urban divide. It is an indispensable tool for making cities all-encompassing, environmentally welcoming, economically vibrant, culturally expressive, and safe for all users” (United Nations, 2008). Therefore, spatial planning must be included if a city desires to be successful and achieve urban development; however, such planning needs continuous evaluation. In essence, proper urban planning does not necessarily translate to the realisation of the better cities spontaneously.

Accordingly, Stead et al. (2004) who have a highlight that such planning requires political vision. This concept should translate into the physical reality of these cities for approval of the necessary resource allocation and budgeting. Moreover, it comes with the opinion that neither urban planning nor spatial design is ethically neutral activities. “In many countries, planning systems and decisions often protect the interests of the wealthy or are limited to beautification and decoration of urban spaces” (UN HABITAT,

2005). In many developing countries' cities, South Africans included, the existing planning systems and practices are dependent on colonial laws and are designed to support spatial separation and act as a population regulator. Consequently, these planning systems fail to meet the desires of urban residents. Likewise, the urban model that they support is evidenced by being both affordable and inadequate. The models do not address the diversity of the urban lifestyle and needs of developing world cities (Department of Transport: South Africa, 2010).

On the contrary, "urban planning in the developed countries was initially regarded as a tool for the expansion of newly industrialising cities. However, presently these countries have to cope with processes of de- industrialisation and shrinking populations. Moreover, city forms that were deemed as advanced and efficient are currently under intense criticism for the consumption they command, as global climate change awareness dawns."(Koresawa & Konvitz, 2001). The failures of spatial land planning in the past have resulted in informality and poverty; hence, it can partly be blamed for the failure of cities. This is because they are the driving force for economic development and absorbers of excess labour due to rural to urban migration. Hence, for urban planning to play a supporting role in urban growth, it needs reliable evaluation and reinvented mechanisms. Recently, there has been a global compromise on the need to imitate modernist development designs. So, to ensure this is achieved, urban planning should be at the forefront to provide critical responses. Additionally, urban planning should deal with strategies to build up cities that are functional for all residents. They should offer opportunities for all social classes, and ensure "communities and their concerns are at the heart of decision-making on development) (Xie, Yu, Bai, & Xing, 2006). With this relation, a new urban spatial planning practice in the setting of the twenty-first-century urbanisation can convert the main challenges faced by cities into opportunities.

4.2. To work with informality, instead of working against them

In the colonial era, planning was patterned to segregate citizens based on their economic measures. As such, poor people inhabited slums, while the wealthy occupied suburbs. However, in the recent past, the integrated model encompasses all social classes. Further, the system seeks to find the means to guide proactively and construct the involvement of informal practitioners and resources for city development. This is after the realisation that using formal planning methods to deal with informal or social differences is of no benefit. Accordingly, both poverty and environmental destruction continue through segregation in cities because the illegal acquirement, subdivision, and development are practised in the slums of many cities in developing nations. Supportive guidelines help deliver better outcomes than segregated approach planning (Xie & Batty, 2006). Soga (1989) also observed that urban planning could convert into a mechanism that includes the slum prevention if it is deliberate and taps informality as a development force. Also, the improvement of the slums and the strategic use of spatial planning mechanisms, including the construction of the stem infrastructure, structured land development, or land rearrangement. Also, the inclusion of integrated transport is possible avenues. Therefore, collaboration with the informal sector

strengthens the acceptability of planning and regulatory systems; consequently, it achieves adequate standards and regulations (Soga, 1989).

4.3. Addressing climate alteration and bridging the green and brown agenda.

Through Environmental Management and Planning under this view, the primary indicator is the need to cut or manage the environmental footprint of cities. Also the deliberate on alternative development paths towards a 'carbon economy', Thus offering another opportunity for invention and improvement of existing infrastructure. In summation, the responsiveness generated from climate change also strengthens opportunities for environmentally sensitive land-use planning and hazard reduction strategies. As such, issues, such as modern transport means and restructuring informal settlements, are highlighted. In this light, planning takes on climate justification and adjustments at the city level by embracing a more conventional conservation mechanism with the objective of building environmental benefits for all. Therefore, By interacting with local ecosystems, modernising the usage and the energy requirements for transport. Also by supplementing urban activities and humanising consumption patterns, urban planning can manifest to becoming a prime mechanism for sponsoring a healthy and well-mixed climate change response.

4.4. Informal settlements are attributed as influencing insecurity.

On this note, it has been realised that urban planning is a significant driver for the reduction of urban violence and insecurity. Also, as the stimulation of inclusion of all urban dwellers through an emphasis on the quality of public zoning in cities and support of public interactions. It has been realised that urban planning ought to be 'conflict-sensitive' and should not aggravate societal inequalities. Consequently, forced evictions in many cities' informal settlements are the practice in disadvantaged sustainable urban planning. Due to this practice, a manifestation of security estates started, where controlled access to the estates is offered to the community living in the holdings. This means to accommodate the safety requirements of the wealthy inhabitants. Taking note of the above, spatial planning acts as development function and as a regulatory organisation. The governments use the regulatory component of spatial planning for approval of development activities.Hence, as a development instrument, it is used as a mechanism that the government uses for the delivery of services and infrastructure, which are necessary for the establishment of the directions for urban growth. Also, to have an a deeper understanding of the spatial planning role in integrated transport, various aspects of spatial concepts in this research have been shaped by the following key principles: Land-use and transport policies are highly interdependent.. This aspect is concerned with amplifying the financial rate of return involved in urban road networks.

As such, the way to address this concern is by accepting the good land-use and planning Policies. In this way, consolidating the land-use planning and the Informal Settlement growth in South African Cities' transport policies are given focus.

As a means of keeping efficiency and envisioned the significant transport performance of the national road network, while instantaneously promoting a change over towards greater use of public transport.

Assuring high standards of safety and protecting state investment in roads. In the endeavour to construct motorway entrances for the metropolis road network, this calls for a rise in the creation of additional space for on and off ramps that present secondary safety risks to the motorist. Therefore, road agencies must uphold a strategy that aims at preventing an increase in the road developable along urban roads where speed limits should be greater than 50 kilometres per hour with the commitment of reducing road fatalities and injuries.

Future Design Capacity. In the accordance line with international practice, urban spatial planning advocates the avoidance of early obsolescence of transport networks. In designing or upgrades of the metropolis and junctions, the agents are to ensure that planning takes into an appropriate allowance required for future expansions. This they do by adequately expropriating the necessary land reserves along the route warranting satisfactory provision for long-term growth. Planning is to be the primary driver of Development. The planning method for urban roads should consider appropriate future development patterns and requirements. Similarly, the city development and regional programme processes must consider trip demands coming from projected development policies and try to find ways to deal with how to prepare for these. Accordingly, the numerous ways in which people travel has some influence on the sustainability of a nation. For example, scholars have identified utilisation of vehicles and the direct consequences of this such as emissions and fuel consumptions are unsustainable. Also, as part of this research, a link between urban area description and community's travel patterns are treated through transport means. Therefore, under consideration is the influence of urban shape and mobility, in addition to the influence of the role of spatial planning in that relationship. According to William et al. (2000), in the current discussions, there is a rich history of the cities' sustainability due to the impact that the urban form of its structure, the population density of the area and current arrangements

Moreover, contemporary researchers and experts in planning have deliberated on the effects of the urban outline on various elements of sustainability, including social equity, accessibility, environmentalism, and economic well-being. However, travelling patterns and transport in and around the cities has received much attention, in particular, their contribution to the progression of the cities.

Notwithstanding, the focus on the most suitable urban shape to enable sustainable transport solutions. Sustainable transport is the types that reduce trip journey and trip time; the decrease is dependent on vehicles support on efficient public transport. They also encamp the integrated transport means that are designed to reduce transport-related pollution and accidents. Consequently, the projected result of sustainable transport is an encouragement of the controlled solid urban layouts. The arrangements incorporate the distances from the origin to the travel node that is to be with proximity to each other. This,

therefore, means The paramount objective of the densification of cities can be directly translated into the viability of area's public transport, with this limited city extensions and more focus on the increase in the spatial densities. This can be achieved by better zoning of the land and limiting urban expansion. In turn, this upholds public transport viability and the better urban design (World Resources Institute, 2004).

4.5. Public transport sustainability

Urban planning and design should call attention to ways to bring people and places together through the creation of cities that embrace accessibility, rather than increasing the length of urban transport infrastructure or improving movement. Thus, through the broadening of objectives to adopt accessibility, it may lead to a wider collection of methodologies for physical planning that may call for better land-use management. Likewise, attention towards more accessible cities, described through sustainable urban densities, upholds promise for relocating motorist to use public transport, bicycle and walk more. This can be achieved by public transport routes priority and provision of bicycle paths, and sidewalks. Therefore, accessible cities inspire a shift towards more sustainable transport modes. Nevertheless, urban densities are required to be cautiously organised and designed so that dependencies on land use complement each other. Instantaneously, harmonised and integrated planning must occur on several scales. Residential planning designs can reduce movement conflicts and allow inbound travel, thus encouraging non-motorised transport at the local level. Consequently, regional level planning guarantees balanced growth patterns that affect trips within the city while allowing efficient travel streams. Of equal importance is a strong institutional framework, governing and planning tools that enable regional partnerships, and cross-sector collaboration. Conversely, political thinkers attach significant meaning to comprehensive planning frameworks that ensure adherence to all segments of the community, including vulnerable and disadvantaged population groups in informal settlements.

4.6. Fundamentals of Spatial Planning

Even though there are numerous spatial planning models for in practice, there exist fundamental philosophies that strengthen the comprehensive framework of existing laws and policies of spatial planning. As such, this chapter describes the following six key principles: "Democratic principles, Subsidiary principles, Participation Principles, Integration principles, proportionality principles and Precautionary principles." (Anon, 2008)

4.6.1. Democratic Principle

The democratic aspect of spatial planning is subject to the form of government in which the policies are embedded. The living arrangement of all citizens is as a result of the space planning being the nucleus of all authorities.

Citizens. Spatial planning assists the government in formulating sound planning policies. So, it is especially imperative that planning decisions be made through a genuine power by physical structures that are democratically accountable. In Appointing politicians to power and for them to implement all legal decision ensure that legal decree is followed by a consultation with appropriate experts. Accordingly, such policies ought to be according to procedures that stem from the law that protects the justice of institutional and human right that is done in a uniform structure. This means that all stakeholders and all arms of democratic government are incorporated.

4.6.2. The Subsidiarity Principle

This principle suggests that local requirements should inspire the decision-making process. Nonetheless, the principle of subsidiarity recognises that, at times, it is essential for that decision are taken at senior authority levels. This is due to the aim that is followed, which might not be adequately tackled at the societal level. For instance, while a nation is working towards an integrated transport means, local inhabitants, especially in informal settlements, may not agree accordingly. In the same vein, the resultant of decision-making at the highest degree is receiving the all comprehensive benefits.

This will mean that numerous planning matters may spill over from one region to another, across municipalities, to the metropolis authority. At times, the argument for surrendering some decision-making to a senior level that covers a larger area and bigger projects to avoid disjointed spatial development strategies demands the intervention of the subsidiarity principle. The nature of decision-making in these policies would equally involve the administrative and the political authorities due to the intertwine unavoidable shared responsibilities.

4.6.3 The principle of participation

Spatial planning in practice has an enormous and direct impact on the resolutions that are taken such that it requires open participation in expanding decision–making in order have democratically aligned methods.

Therefore, efficient techniques grounded in community involvement can heighten the legality of such policy development and implementation. Accordingly, the process of decision-making creates a way of local ownership and ensures that the local citizen’s rights are well considered. The rights of property and land owners should not be overlooked when spatial decision-making is made. These considerations should be transparent such that conscious reasoning is behind those choices that are made. This requires that citizens ought to have access to the project information/proposals, planning and policies, in addition to access to the officers and legislative commissions making such decisions.

5. CHAPTER FIVE: PUBLIC TRANSPORT

5.1. Public Transport System designs

The public transport agencies that manage the public transport entities forms a particular integral in the metropolitan strategic outlining in addition to urban management. Most urban methods in South Africa and several cities in the country miscalculate the endowment of public transport. Nevertheless, there is repeatedly disassociation amongst transport policies and land-use arrangements. In the same token, it has been proven that urban land-use policies that fail to integrate existing transport plans tend to concentrate on infrastructure instead of transport efficacy and connectivity. Accordingly, the inability to effectively deliberate on the standard of public transport networks in land-use strategy analyses potentially produces flimsy plans consequences in two significant ways. Number one is public transport facilities servicing new land uses is ineffective. Consequently resulting in reliance on informal travel modes Number two, the inability to discriminate the suitably designed regional public transport systems might lead to the omission of particular land-use selections. Accordingly, such exclusions relate to the placement of land- use forms or their design, like over-provision of parking areas. The on-going dialogue about whether to discourse urban vehicles dependencies through land-use amendment or transport planning is the issue at hand (Newman and Kenworthy, 1999). Currently, the literature base that is vast increasing that is extensively valuable, hence the demands enhancements of the public transport system designing in addition to their coordination as a mediation of reducing dependency on informal transport means. Further, the identification of integrated public transport system strategies as an aid in decreasing informal transport systems. This is vital because it affords planners a further or alternative instrument manage urban transport configurations not only the stark land use disparities or investment in modern infrastructures. For this particular reason, urban planners are still to be educated through a wider spectrum of studies concerning public transport systems. The wide-ranging knowledge is, however, a nuclear on the engineering and the finances of public metropolitan integrated transport networks. The fact that the public transport systems designs are not well documented with their strategies, mainly concerning the habits that underwrite its prosperity. Similarly, the operation of the networks is also not documented. However, some existing knowledge that prescribes to public transport system models in South African cities that are renowned for their highly centralised outspread. This outspread includes the rail networks with buses or feeder bus systems that are decently designed within the central urban areas, meanwhile this lower on the peripheral residential areas of the cities.

5.2. The Policy Significance of Public Transport

According to history, public transport systems have been operational in the towns for hundreds of years. However, over the years, the transport systems have advanced to include a variation of transport modes operating across a combination of landscapes. This includes the elevated and underground type systems. For instance, engineering accomplishments of public transport networks are considerably outlined with

systems of Public transport utilised. For example, in a subway system that uniquely New York. The famous London Underground and the Paris Metro are also the representation of the advance of this advancement.

Nevertheless, the wider structural frameworks that give authority to the operators/agencies of the Public transport systems in arranging and operating the network in a comprehensive manner, particularly in widespread cities have been misunderstood. In this view, in the past two decades, there was the rising identification that efficiently operated public transport in the planning stage must be an integral system that continuously promotes multi-destination travel.

Thus instead of taking particular singular lines that are servicing single trips. Public transport designing should consider all the Spatial planning with the consideration of Land use. It should be planned with the view of being coordinated. The routes should be swift, continuous and easily accessible. There should be an integrated approach to the coordination of both land usage and transport systems, the planning should be geared up towards the foremost prosperous and economical means of moving people. Accordingly, there needs to be a high priority for public transport by developing highly used public transport corridors that are connected to the development nodes amongst the corridors. The system is to plan around widely spread networks that unite the maintain a multitude of transfers. This is on top of the fact that the public transport system should attempt to service each potential destination mixture. Over and above that the planned public transport system should have little or no impact on the environment, but rather it should complement it. (Mees (2000; 2010).

Further, Mees (2000; 2010) states, "the birth of public transport systems as networks rather than individual routes can result in higher levels of backing than the planning of different routes. This due to the unexpected trip behaviour that the system can support and which policymakers may have failed to predict" (Mees 2000; 2010). Accordingly, the network impact that Mees defines will result in increase patronage over the ones predicted through standard single- route value benefits assessments of public transport systems because of the high demand variability concerned. Equally, the existing proof that system designing of public transport is prominently crucial for the isolated city regions, this, in particular, where the demand is evenly distributed.

Thus, the phrase public transport system designing is utilised explicitly in this mini-dissertation in defining the rigorous organisation of integrated public transport networks with an aim of achieving the network effects.

5.3. The system design for Policies for Public Transport

Ordinarily, the principal problem for public transport decision makers (particularly in South African cities) is to arrange a predetermined spatial system of predetermined lines. This is to respond to demands for

travel that are nearly boundless for the inhabitants of such cities inside the existing organisations and functional limitations caused by either financial and management.

Accordingly, existing empirical indication suggests that the realisation of a high-level public transport patronage can be attained. This is “if public transport networks are designed to serve multiple passenger classes and simultaneously be able to meet diverse travel demand patterns”(Mees, 2010). To overcome the constraints that are imposed by the physical barriers, realistic planning should be employed when dealing with the public transport system in an urban form. In the argument put forward by Meeser about the influence that both the designing of the network system and the organisation itself. This has an enormously influential role than what has been documented previously in the transportation literature in association with the impact on urban form.

“Unquestionably, such influences are mainly acknowledged, but not particularised in primary transport and land-use planning theories” (Mees, 2010). Therefore, coming up with efforts applied to public transport networks will facilitate in resolving the shortfalls of disjointed and division of suburban space. Since management and interconnection of public transport will enhance the disadvantages of disconnected and division in the urban area. The design of public transport services needs to do in an integrated form that accommodates diverse modes of transport. These modes need to be safe and value orientated and to attain service quality. An efficient land transport system should be achieved by designing a service and infrastructure that combine the provision and regulation that is backed up by law enforcement that is efficient and on alert. This will provide a safe, reliable, cost-efficient and accessible public transport system.

5.4. The Philosophies adopted in designing the Public Transport Network

Public transport provides significant support for sustainable spatial policies like the densification, urban stability and tactful nodal development. It is thus imperative to emphasise the link between the planning of transport systems and the land due to their intertwined connections. There are two existing primary principles in support of the network impact. The fundamental principle involves the supply of the public transport system with the lines that are straightforward, unchanging and interconnecting daily. This is done using a framework and timetable that is stress-free and easily rememberable to the user. (Nielsen et al., 2005). The stress-free in this environment suggests that these lines are direct transport routes and they operate at a faster speed from one nodal point to another. There are intersection points at nodal for changing from one route to the other. Also, it indicates the service frequency throughout. Therefore, the patrons can memorise the timetables of their frequently used routes and times. (Mees, 2010).

Consequently, the second fundamental principle in the designing of the system is the acceptance and the complementary suggestions of the bulk of travellers. There is a requirement for service transfers to access other destinations of choice.

The transfer service requirements are intensified by the widespread cities that experience either modest otherwise restricted degrees in activities. Accordingly, such transfers are enabled through synchronised timetables amongst transport networks to minimise passenger waiting times. In essence, this is conceivably above certain par feature of successful system designing. However, it is usually ignored by policy makers of public transport planning in cities. To attain a "network effect", some the principle operational practices that reinforce public transport operations planning must be observed.

5.4.1. Foundentental 1: "Simple and Direct Network Structures."

This demand The arrangement in this fundamental is that the network is based "one section –one line". The design of the system requires a path travelled and the physically tracked routes to be distinguished separated. (Nielsen, 2005 p. 94-95). Thus, this concept observes the principles to afford simple and "direct lines whose physical routes are easily remembered whether individually or within a wider network". The other significant fact is that routes for the public transport are physical attributes. However, they are less important in the designing at the system level. Line system arrangement plans should pursue combining and concentrating several other adjacent lines that are of the similar structure into combined lines that enable higher density and direct routes.

Hence, on such an arrangement, practicable lines should operate as diametric (crosstown) "to support some through-passage at primary action centres and interchanges" (Nielsen et al., 2005).

5.4.2. Main fundamentals 2: Network planning design using line prioritisation

The essence of public transport planning is centred around lines hierarchy. A well planned public transport system should include a multitude of lines that operate at varying speeds, varying capacity, varying distances and varying feeders systems. The range can be from mass transit to local connecting lines, feeder lines and other routes like local networks.

The lines hierarchy needs to be interconnected and be of different categories such as higher capacity, speed and suburban connectivity.

For example, the frequency of the services does aid the requirement of system harmonisation, in particular, related to informal transport. However, in this grouping of travel lines, some operational planning attempts to guarantee reliability and consistency of service speed are required. Therefore, the design of the system for these lines is centred around safeguarding arrangement and capacity rather than frequency and scheduling.

5.4.3. Main fundamentals 3: The deign that incorporates speed, reliability and consistency

Equally, the design speed of the service that can be compared to the time it takes to travel from door to door form part of the public transport plan. As such, this involves vehicles in a position to move faster on a route that has less interference such as traffic and intersection to afford consistency. In the aim to support the vehicle public transport system prioritisation, a public transport right of way system needs to be implemented. A designated public transport lane is therefore allocated and it is operated during the peak hour periods. These lanes have designated timetable with stopping arrangements at Peak operated hours. On the hand, the lines running inconsistent are to be scheduled such that they are rememberable.

5.4.4. Main fundamentals 4: Coordinate Convenient Transfers

Fast and secure transfers sustain rapid journeys to disperse terminals within a public transport network in a city. The coordination of speed and frequency, in particular where the public transport provides high-speed routes be critical and forms the basis of the public transport systems. Accordingly, there is a requirement to better coordinates other routes such as the local routes that need much attention that the main high-frequency routes that afford public transport network fast, dependable and consistent for the urban dwellers.

5.4.5. Main fundamentals 5: The provision of the service information that precise and reliable

Accurate service information that is readily available to the passengers is a significant constituent of the public transport network. As such, service centres are to deliver vital information for travellers to locate and navigate them through the public transport system. Therefore, information relating to scheduling frequencies and information concerning zoning and fares on that line should be available. Also, all the main train stations should provide a ticket purchase service. This benefit to the fact that less comprehensive information is needed for the high-frequency informal travel networks since the information on the irregular is much harder to distribute due to the nature of unpredictable timetables.

5.5. Planning Line Structures for Improved Network Function

As noted above, the critical fundamentals of the public transport system links the organisation planning with the designing of the public transport systems.

Further, it is a proven fact that principles converted into fundamental operational activities tend not to be forthright, especially when numerous issue are to be considered.

The public transport systems operation is progressed by the systems, consistency and application of the above values that are continuously adding value to the network.Therefore, this type of planning encompasses of these key features: In particular the simplification routes and the entire system.

5.5.1. Determining the whole system

The system completeness defines the operational capacity of the Public Transport network. The value of the system is in the passengers able to travel all over the city areas. The ideal transport system is the one where the passengers are given access to all spheres of the city; this should be the purpose of any public transport system. These are achieved through routes that have connectivity, are programmed to frequent the paths at high speed. On the hand, they have to be reliable and have options to other paths that the passenger may find desirable. The system is thus best equipped with the route map that shows all the different routes with the available connectivity. It thus noted that “the most significant difference in a public transportation system plan is the variance in the hierarchy between high-frequency informal transport networks. Whether cross- town or inter-suburban, and less frequent lines because this clearly describes to passengers the regions/zones of fast and easy compared to slower, less secure travel forms public transport system map.”(Nielsen et al., 2005).

5.5.2. The route design should be simple and rememberable

In the current public transport models, there is an emphasis on ensuring that the routes design are simple and are rememberable to the passenger. The passenger’s expectation and desire are to travel with ease and will fewer complications. Therefore, the above fundamentals afford this to them. Also, public transport routes free from ambiguity, interferences and disruptions are the most desired. In the identified fundamental to the designing of the public transportation system afford the system the opportunity to be optimal and user-friendly.

5.6. Timetable coordination

The system design and “the timetable planning is collaborative”. (Vuchic, 2005). This means that the network of lines avails system spatially linked routes that well scheduled and that provides connectivity.

5.7. Design of the fare system

The focus on creating a system that accommodates a diverse multitude of transport services that allow movement of the user without subjecting them to additional connecting cost but rather to provide an integrated ticketing system. The inter-connectivity of the system design will allow transfers from one route to another. The systems should save on travel time, be seamless and without additional cost. The viewpoint in the system design should be that the user benefits of time-saving between transfers, but also on the route journey time for the benefit of system operational speeds.

6. CHAPTER SIX: TRANSPORT ECONOMIC OUTCOMES

6.1. Introduction

In essence, public transport services are essential to the urban economy in several ways. These services give the communities convenient travel to different parts of the city. They also reshape the urban form in and around the interchanges, they promote densification, encourage mixed-use developments, promote local economic development in particular when it comes to workplaces. As a result of less car usage, they also reduce the carbon emissions, providing a longer term environment. In the evaluation of any public transport systems, these above features are to be considered together with cost benefits, capital investments and rate of return. Accordingly, the focus of this chapter is on investment integration with the public transport sector, what are the spin-off in the investments(i.e. Job creation, support of local businesses and empowerment in general).

The chapter highlights the policies that relate to the public transport investments that yield the benefits mentioned above. Also, sustainability concerns have increased over the years; it is thus important that the transport policies be assessed accordingly, and a balance between the financial, environmental and social influences is met.

In this chapter, an attempt to create a framework for the public transport sustainability assessment, also, re-examine of policies on the land use and travel patterns as a mechanism to provide valuations.

Further, extensive investigation of the influences of the transport policies and the land-use and the consequences that the present on the financial system and other public issues. The complications that the modelling needs to take into consideration the land use, the current travel patterns and other influential factors that are associated planned land usage and travel patterns policies.

Secondly, the means to integrate the trends in the global economy and other indirect contributor.

Thirdly, the need to develop the skill pool on the subject matter such that other factors like environmental and societal effects are incorporated into policies, and that balance is struck between all these different aspects.

Granting that recent model improvement enable inclusive approaches that differ to the currently used models. There is thus need to do more research to improve these models, both in the application and, in theory, to incorporate such factors as sustainability. This will include the assessments of both the land usage and policies around travel pattern and consequences (Puget Sound Regional Council, 2005).

6.2 Economic Impact of Public Transportation Investment

Accordingly, key outcomes of this chapter will be organised regarding three groups. First, the consequence of the investment in public transport is employment creation through access to job location and development as a direct result of building transportation systems.

Second, public integrate transport permits e range economic productivity plus it has an influence on the unfolding the pertains to variations in travel times, costs, and access elements.

The third group includes deductions concerning the understanding and policy matters of economic influences associated with the integrated public transport investment.

6.3. Primary results

The results of investing in a public transportation system that is an open call for the system that offers travel time savings, development of infrastructure, it raises the number of jobs and indirectly has financial benefits to the region that it serves.

The job market in South Africa benefits much from infrastructure development. A conducted survey indicates that nearly 50,000 jobs can be created and supported annually, 470 billion rands that are invested in integrated public transport with the inclusion of operational activities. The ridership increment in public transport has a bearing on the rise of the economy, the direct and indirect results can be seen in the investment boost. It is articulated that for every Ten million dollars spent on Public transport capital investment, there is a thirty million dollar business boost. (Capecodtransit.org, 2015).

6.3.1. Public transport primary result

Public transport as primary goal provides mobility to society. The access to places of work means that the population can be more productive and business investment can grow as a result of this movement. The consistency of the movement means that there can be continues interrupted growth in the sector that will lead to affordable means of travel due to the increased number of public transport users. There will be a move from private vehicle usage to a more public transport oriented society due to consistency, affordability and reliability of the public transport system. This will see a reduction in the traffic congestion and the cost of travel in particular for businesses that provide travel services suing the private vehicles. The affordability level of travel thus becomes attainable, meaning there is more supplementary free spending for the society households.

The mobility and access to city centre mean more businesses can be obtained resulting in growth in companies that were located in areas that were not previously accessible by public transport.

6.3.2 Systematic approach to assessing sustainability

On the view that public transport relies much on the Land-use and other forms of transport mode, a systematic approach to the assessment of public transport is thus needed. The pointers utilised for the evaluation of the effectiveness of the plans and modification of the transport and land use should be given an illustrative, quantifiable, and theoretically founded systems. These are to collaborate amongst others in the environmental and socioeconomic structures with the land use and the public transport systems. Accordingly, there should be a mechanism that is receptive to the changes in the land usage and the public transport system. In addressing should address central principles that uphold intangible formulated models that through the land use and the public transport encompasses interdependency within the land usage and public transport interrelation.

6.3.3 Precisely, land-use systems comprise the following:

The allocation land and the building distribution of the land area that is locations for distinct land-use functions, such as recreational parks, residential areas, offices, schools, and shops, among others, and also such contributing factors as system design, the land usage and the area's densification.

Also, socioeconomic plans for the area and undertakings, such as accommodations, work, shopping, education, and recreational locations.

As the results of spatial arrangement, clash exists in the demand and supply of land. This is evident in the interaction arrangements amongst the inhabitants'. With land-use scheme, a generation of travel patterns can be established such as consumers and goods. With the inhabitant socioeconomic features, their requirements and prospects are exposed to the consumer's inclination and outlook. Equally, the pertinent matters and the position that is articulated play an influential role in the establishing the transport objectives; these contributory factors are the cost of travel and the benefits of travel. (Steg, Vlek, & Slotegraag, 2001).

Additionally, these needs to be measurable using their accessibility. The accessibility dissemination of established the resolution on the land use regarding the business locations and the households positioning and determines firms' consequences of modifications to the land use arrangements. Also, the relative matters that partly establish the operation and effects of land usage and transport structures. In summary, the relative matters encompasses the following:

6.3.3.1 The economic dynamics related to the increase in economic activities, available jobs within the urban areas.

The other related matter is the city demographics, in this case, age spectrum and earnings profiles. Also, the area natural resources and the advancement in technology add as new contributors, this mainly

reflected in information and communication technology (ICT) as well as transport technology. Moreover, governmental policies through the advancement of transport technologies that transcend in better taxation when it comes to fuel and the transport systems themselves. This has direct or indirect consequences when it comes to land use and transport systems.

6.3.3.2 The accessibility impacts.

The functionality of the land use and the transport employs numerous pointers that can be categories in various ways. A method in which advancement is harmonised in the transport network is clustered in the following:

Relative sluggish improvement, these are based on the predominant physical organisation of land use.

Intermediate advancement, these are based on infrastructure usage that a lifespan depended up for decades and those that have a construction firm plans(from designing to construction stage).

Rapid advancement, these refer to the undertakings that transform within a span within 12 or so months.

Imminent advancement, these refer to a transport patronage within a radius (typical in 1000 metres) on both passenger numbers and the number of cars. Also, the available modes of transport within the radius that is available.

Moreover, the accessibility processes are employed in defining the transport system or with a combination of both land utilisation and transport networks functioning.

Four categories of accessibility measures are identified accordingly, the first category that is based on the servicing of an existing metropolis through the available transport systems. It mainly manifests through levels of travel patterns and subject travel matters such as traffic congestions. (Geurs and Van Wee, 2004).

The next category position primarily based accessibility measures. This describes the extent of accessibility to spatially- spread undertakings. Also, individual primarily based accessibility processes characterised individual's level of accessibility. Finally, advancement in infrastructure, primarily based accessibility methods analyse the financial advantages that a city dweller derives by the accessibility they gain to spatially- spread activity.

In essence, the usage of the transport network is established through the accessibility of developments and infrastructure due the sensitivity it bears on the amendment transport systems. Conversely, variations land usage and transport networks are further types that are susceptible, meaning modification

in accessibility may be an effect of land usage changes relating to the cost of travel and time of travel. (Geurs & Van Wee, 2004).

6.4. Economic Impacts

Globally, the economic effects of transport structure changes are theoretically diverse. There are several ways in which the economic effects can be categorised; these can direct financial spin-offs from the development of a project that is directly linked. On the other hand, the indirect financial spin-offs that are not project related, but have any influence on the project. (Eijgenraam et al., 2000). On this note, direct economic benefits are sub-classified into benefits of use. Which manifests through travel cost savings (which is naturally the most important classification of infrastructure projects), and the passive-use benefits, which covers several impacts like significance on alternatives and existence and also the indirectly related benefits. On the other hand, outcomes due to the differences that emerge upon distinguishing economic implications for which market prices are accessible. For example, through profits and a reduction in the cost of fuel and the consequences price market that are unknown but are presented.

These are presented in a financial means, for instance, the advancement in the travel time with the environmental impacts. Further, the calculation of household and industry benefits that directly linked are widely determined by the macroeconomic welfare theory that centres on the patron's left over income over their willingness to pay. Accordingly, the method represents the CBA. The widely recognised "half rule measure" should be utilised in the conservative evaluation of projects relating to transport as a means to determine the patron's left over income. (Simmonds, 2003).

Thus, it should assist in the estimation the comprehensive advantages attained by existing arrangement of patrons of origin to their destination. The other half of the gains should be established from new patrons. The appraisal approach is misinterpreted when future land usage is likely to change due to designs predisposed by strategy. (Simmonds, 2003).

Therefore, the remedy for this shortfall is achieved by conducting a comprehensive evaluation of both the land usage and the transport patron advantages based on the reaction on the changes to transport policies. (Martínez & Araya, 2000). Conservative economic assessment approaches of projects linked to transport should look into benefits that add value to the transport use while other use should be given minor consideration. These other uses are mostly sub-division of the advantages that are not included in the primary transport usage. These are categorically divided into the following three types: the existence and alternative values and the indirect benefits.

6.5. The Wider Economic

Benefits of Transport From the above explanations, it has been proven that lowered costs and increased accessibility that result from improved transport. Similarly, it transforms the marginal costs of transport producers, the mobility of the household, and the demand for goods and services. Accordingly, these changes accelerate throughout the economy with the aid of existing market mechanisms affecting sectors, such as employment, output, and incomes, especially in the short-term. Further, dynamic development effects resulting from an improvement in transport trigger several linked economy-wide processes and generate a range of sectoral spatial, and city effects. It has been highlighted that lower costs and improved accessibility, due to the improvement of both transport infrastructure and services, expand markets for the general economy. Another economic outcome is reflected in increases in property values near a public transport station. In essence, this primarily denotes a capitalisation in the savings in both travel time and access financial savings that linked to these zones. However, it has been noted that the positioning of the commercial hubs habitually arises from the proximity of the public transport stations because of the accessibility of these areas by the job seekers, employees and consumers. On the other hand, the benefits that public transport has on area economic growth and the advantages that eventually require evaluation within the framework of other significant consequences, for instance, government drive for development and the active role played by private businesses in the area that may bear much important influence based on the existing conditions. (Weisbrod, 2008).

6.6. Summary of Economic Results

The Metropolitan Transportation Plan for South African cities attempts to match the development of a multi-modal transport system whereby land use and economic objectives of the community, especially in informal settlements, are highly regarded. A high capacity transit system in collaboration with an integrated transport investment is a critical factor in South African city strategies to move the growing population efficiently and influence long- term land-use development patterns. As a primary partition of the planned integrated transport system, investment in high capacity transit (informal settlement zones) equally contribute towards the long-term economic health of these urban areas. As it has been proven, assessing the economic results of transport investments is a challenge because of the existence overlap of both direct user benefits and indirect economic development benefits that could have double counting outcomes. Thus, in many instances, indirect benefits repeatedly reflect the same benefits that are also expressed as direct benefits. With this understanding, the chapter has evaluated the two types of benefits differently. Direct benefits, due to constructing integrated travel links (especially in informal urban settlements) have been observed. These have found to help direct transport users through travel time savings, vehicle cost savings, transit option values, and air quality benefits. Accordingly, these direct user benefits mostly exemplify new or additional economic gains to the urban zone affected by the transport

development. Therefore, it is wise to note that direct benefits to the economy mirror efficiency gains, for instance, lowered household costs or saved the travel time that is channelled to other beneficial economic activities. On the other hand, indirect economic development benefits that have been highlighted in this chapter include benefits associated with increased or inflated property values and changed land-use patterns. These are advantages related to improved access to jobs for a majority of the metropolitan population, in additions to the benefits of employment, wages, and productivity. The qualitative valuation of these benefits attempts to recognise the influence of new economic gains generated and whether the benefits characterise a redistribution of economic gains.

7. CHAPTER SEVEN RESULTS

This chapter discusses the major findings and results obtained from the literature reviewed in this mini-dissertation.

7.1 Informal Settlements and Public Transportation in South African Cities

Extensive literature reveals a symbiotic relationship linking human settlements and public transport systems (Atuahene 2004; Bertaud, 2008, 2010; Moses & Satterthwaite, 2008; Turok, 2010, 2012; Huchzermeyer, 2006; and Tshikotshi, 2009). As such, problems in either factor have direct influences on the other. Accordingly, the increase in informal settlements has direct influences on transport in South Africa. For its part, transport planning has a direct effect on human settlements in South African cities.

7.1.1 The Impact of Informal Settlements on Transport

From the literature review, the proliferation of informal settlements serves to distort and fragment the urban form regarding net population densities. Urbanisation and the failure of the state to adequately address the effects of the colonial and apartheid land-use systems have been identified as major causes for the increased number of informal settlements in cities in South Africa. They directly resulted in the growth of the population on the peripheries of cities rather than in urban centres, creating an inverted density gradient due to middle and high-income households residing in lowly populated suburbs. According to Turok (2012), the pattern of population densities in any city has an effect on the overall cost of transport as well as the supply of critical infrastructures, such as storm water systems, electricity, and water, among others. Specifically, uneven density results in inefficiency and injustice since it impedes the functioning of housing and labour markets, making it difficult to distribute public amenities across the city as well as undermining the provision of efficient transport systems (p. 21).

Accordingly, informal settlements have three critical influences on public transport systems in South Africa. The first is that this form of settlement is exceedingly weak concerning capital infrastructural and operational costs. As a result of apartheid and urbanisation- induced fragmentation, South African cities have the lowest population densities in the world. Consequently, servicing these low-density fragments with public transport infrastructures is costly and is mainly road-based or car-use oriented. Moreover, the

state is often forced to provide public transport at subsidised costs due to the long, and expensive trips individuals must make from informal settlements to cities. This increases the fiscal resources used by the state to provide and maintain these services (currently estimated at R5 billion per annum). Second, those who live in the overcrowded informal settlements located on city peripheries are forced to spend more time and money travelling to urban centres or work and school. This is despite the fact that the majority of these poor households earn less than R500 monthly. As a consequence, the public transport cost and length of travel often involved inhibit the individuals from the lower end of the economic spectrum from participating in various economic opportunities in cities, which is added to increased unemployment rates. The impacts of those who are employed are both low saving rates and a loss of productivity since the transport functions as a type of regressive tax on their income. Third, due to the widely dispersed urban shape and low densities, it is impossible to implement and support efficient and viable public transport. Primarily, low densities affect the number of public transport users as well as the mass public transport frequency and viability.

The direct result of this is a lack of choice in transport modes among the low-density communities, ultimately resulting in underserved communities. Consequently, taxis have taken advantage of this lack of public transport supply and are currently predominant form of the transport system in some areas, which results in high fares in comparison to rail and bus rates. Moreover, this system produces disproportionate amounts of vehicle-based movement alongside high costs regarding congestion, emissions, pollution, and energy consumption.

7.1.2 Transportation Planning and Urban Settlements in South Africa

From the literature review, there are four key features of the existing transport practices in South Africa, that negatively affect urban human settlements.

7.1.2.1 Maximising Mobility

The current transport practices across South African cities focus the maximisation of movements. It encourages care based travel instead of increasing accessibility by bringing housing and urban economic opportunities near and in this manner reduces the aggregate amount of movement or travel. In this

regard, South African cities have adopted the concept of the urban highways, that are in two folds have evolved in this manner. Firstly, in most instances, these highways are regarded as the central configuring element of new growth, which leads to two correlated and adverse outcomes. The first consequence is that highways are regularly utilized as a form of direct new routes to developments. Notably, the majority of city plans display systems of limited access routes spread out into the undeveloped countryside and rural areas based on the expected future urban growth. However, these plans fail to consider the desired future settlement forms and understand the natural environment. Ultimately, this has led to the massive environmental desecration as well as the loss of high-quality agricultural land. The second consequence is that this practice encourages low-density sprawl. As seen before, South African cities have some of the lowest net densities in the world.

This has made the existing transport system unsustainable. As a result, one of the greatest settlement challenges facing South Africa in the coming decades will be the reformation of towns and cities to increase net densities, while making them more efficient, urban, and equitable. Also, the freeway manifests as an emphasis on the creation of access routes with the metropolitan area to increase travel movements. Consequently, in the necessary urban setting, these routes act as barriers/walls ultimately fragmenting activities and the entire city. This hides the urban integration and permeability processes. While the establishment of partial access intra-urban routes is essential, especially for efficient freight movement, these should be provided sparingly to minimise the fragmentation effect.

7.1.2.2 Mass Transport Systems (MTS)

Further, to the above it is a requisite for continual public transport investment that is balanced with road base investment with its focus on private vehicle movement improvement.

However, presently in South Africa, there are no comprehensive statistics for road-based investment since the method to do this is not yet fully developed. For example, there is a problem of detaching road based projects ratio with the benefits of mini taxis or buses. Nonetheless, the road-based projects are predominately better invested that the public transport projects. (Dewar, 2011).

Undoubtedly, there are still disparities in public transport investment in South Africa as compared to the global investment in public transport ratio of 58.3% of and 41.7% on roads. Consequently, the inferences of this are far-reaching, for both urban efficiency and climate change. Therefore, currently, there is an increasing acknowledgement that there exists a link between climate change and the discharge of greenhouse. It is thus noted that this is due to the key contributor to this is that road-based transport uses oil based fuels.

7.1.2.3 The demand approach and review of current

Globally, is recognised that the critical element of transport planning, for the most part, is demand-side centred modelling.

This means that future assessments is based on prevailing travel patterns and flows extrapolation. In the South African context where informal zones have remained distorted, this extrapolation helps in the establishment of such distortions.

Accordingly, in such zones, there is little concern for the methods in the transport planning that applies means to rearrange the current informal area while promoting innovate and well-distributed travel patterns.

7.1.2.4 Spatial quality

Spatial quality refers to the general movement networks represent the majority of public space in all cities, whereby, according to Dewar and Todeschini (2004), “public space” denotes all public spatial voids in these cities.

The assumption here is that there is an active position in the urban environment that these areas function as social spaces and the a significant form of social infrastructure.

Accordingly, these areas are mainly relevant to the majority of the impoverish urban dwellers in Southern Africa. Moreover, the most prominent are outlining these inhabitants deficiencies of not been able to do all their daily activities in their areas.

Thus, the public spaces successfully function as an addition to their informal habiting units. They are spaces where social cohesion activities occur such as meetings; sports activities and playgrounds for playing and libraries for studying in particular when the dwellings are congested. In the defining the urban spaces and environment in South Africa, they are viewed as poorly planned spatial areas due to the movement networks. (Dewar & Todeschini, 2004).

7.1.2.5 Summary

Southern African cities have been classified as among the most unbalanced and ineffective comparable to other countries globally, however, there is still a lack of understanding how the change can come to fruition. Nonetheless, the reorganising and strengthen informal zones is an urgent call that should see these cities to a sustained level. Considering that the spatial planning and public and private transport systems are planned in isolation and two different urban planning strategies, it remains difficult to bridge their shortcomings.

Accordingly, several important implications emerging from the spatial planning forecasts covering housing and employment growth.

By implementing the principle of growing urban corridors that link critical economic nodes and regions in the spatial planning will benefit both the transport planning focus and the spatial planning. Is it also important that this be done uniformly in an integrated approach.

7.2 Spatial Planning, Informal Settlement, and Transportation

It is known that there is an urban concentration in South Africa that are predominantly big presently. These big urban centres have been recognised for significant production in the countries GPD. However, the urban growth in these centres are still vastly growing.

Currently urban densities arrangements that are mainly favoured by the apartheid is equally developing into unfavourable spatial arrangements. The result of this is the neglect of the majority of the urban citizen that resides in the poor informal area both economically and socially.

The means to meet the urban development challenge; it will be necessary to implement measures for densification and intensification to limit sprawl. There are, however, considerable pressures to extend development beyond the current urban boundaries.

7.2.1 Distribution relating to spatial planning

Regarding ideal planning strategy in cities, higher densities are the most ideal, this means planned transport measures can be fed by this demand and viability of these plans can be met. It is never the case in South African cities as sometimes an inverse of this occurs where lower densities are on the outskirts of Central Business Districts of the city. This deficiency in the spatial planning has been caused by the early apartheid plan and partly on residential land use. Accordingly, taxation underwrites the discouragement of the subdivision of large parcels located near the city centres.

7.2.2 Provision of residential development in Cities and the current land use in South African Cities

The land allocations for residential development around the South African cities is moving towards both the densification of the CBD area and the using up available lands that are well facilitated with public transport and services. However, the informal settlements that are still under facilitated by both are still to see this shift in policies. Apart from this, informal settlers are only allocated marginal land when it does become available, their areas lack formal public transport and in additions these communities are without private vehicles. These issues are prevailing disadvantages that the residents of these areas still have endured. In the drive to resolve these spatial disparities, modal integration with both public transport and land use development. These areas can be better served with all necessary services, and formal, efficient spatial planning can be implemented.

7.2.3 Investment shortfall of modal-transport

In additions to plans on both Rail and Road mass transport system to serve these areas as mass transits. As a result, they will create transport hubs where other services such as trade and leisure will manifest. In several South African cities initiated planning and/or constructing BRT networks. As such, these new modes have transformed the completion in the informal areas, in particular, those within a 1 km of the

hub. Furthermore, the roads, sidewalks, and public spaces near these stations demand careful design with the aim of to providing convenient and safe urban environments.

7.3 Economic Outcomes: The Role of the Urban Transport System

Travel in the cities/area has progressively become important and it is thus critical that integration in cities includes public transport integration. The shift that integration brings in land use and transport planning in the scheme of improved public transport provision and dominance. Thus, the effectiveness of public transport modes will be enhanced visibility by realigning land use plans, design standards and zoning codes in support thereof. Due to this, scholars and planners associated with this have highlighted the critically that travel patterns and public form link up and it a contribution to the fast pace developments over the past few decades (Rodríguez, Targa, & Aytur, 2006). With minimal settlement restructuring taking place, the existing transport systems in South African cities have been under pressure to service the increasing travel demand and cross- urban passenger flows from the city to informal settlements. With this these are the critical aspects to consider:

- Transport is a crucial factor in creating cities that are more functional and consequently, must adapt to on-going urbanisation, increased vehicle, emissions and traffic growth.
- The access that transport presents in improving the lives of the poor inhabitants of the urban areas give them the opportunities to job opportunities that urban living comes with.
- It is also an instrument of urban change. The integration of spatial planning, land use and municipal services are tools that successfully be the drivers of change in the decision making on city transport plans.

8. CHAPTER EIGHT: CONCLUSIONS AND RECOMMENDATIONS

8.1 Recommendations on Urban Land Use/integrated

Transport in South African Cites “The victory over the apartheid state in 1994 set policy makers in all spheres of public life the mammoth task of overhauling the social, political, economic and cultural institutions of South Africa to bring them in line with the imperatives of a new democratic order” (Asmal, 2001).

Due to the pronounced apartheid in South Africa cities in the 1990s, this first scheme left a distorted town planning legacy. Therefore, town planners, managers, and politicians in charge of urban development had a hard job to undo this pronounced form of planning and undertaking to reconstruct the spatially segregated, highly disjointed, and detached urban societies. In this light, it is clear that issues related to restructuring, renovating, modernising, and integrating these divided cities pose the outlined spatial planning challenges. Brookes and Harrison (1998) observed that in cities/regions where apartheid policies interconnected flawlessly with modernist urban planning values. With such as the idea of development with conviction in the process of understanding tusk on how to resolve the spatial disorder and chaos. The conception that it is only through the implementation of control measures by government and the related parastatal at all societal part and also considering demographic characteristics, in addition to the notion of public, co-exist, the nation can work towards creating better, modern cities. As such, additional endorsement of new policies that shift the broader approach to development in urban designing. Accordingly, this acknowledgement leads to three strong recommendations.

8.1 .1 The Involvement of Public Authorities in the Management of Public Transport Activity

South African cities have indicated their desire to place focus on public transport reorganisations; however, there is still a bolder participation by public authorities to see this to fruition. For instance, a much needed continuity and reassuring political determination, especially on the capacity to direct funds towards public transport. Further, the authorities/government should ensure that sustainable mobility is enhanced for the majority of the city dwellers, rather than the affluent few as the segregated integrated transport planning of the apartheid authority accomplished. Moreover, active participation of governments should assume various forms, including the following:

- Effecting strong legal and regulatory outlines that support integrated public transport operations and appropriate land use in the cities.
- Acting as the chief underwriters for the operators in their vehicle acquirement in exceptional conditions and act in good faith during the allocation of land use taking into consideration the implications of informal settlements.
- Taking part in the capital investment of the integrated public transport initiative so that the government can acquire a better insight into the issues involved and better work towards solutions. Accordingly, the public authority ought to interact with the inhabitants of informal settlements before investing in integrated transport systems to collect and solve any conflicts.
- There is a need to create an authority or other capable agencies responsible for urban spatial planning in both the transport and land allocation sectors. This will ensure that there is a high level of administration and control towards a smooth transition.
- Further, there is a critical need for stakeholder engagement with the government and private sector to put into place regulations and professionalise the industry.

Also, consultation with the private sector will ensure that the development of an integrated transport system will not distort land allocation policies that may arise due to the migration of firms to the serviced areas.

8.1.1.1 Issues and Importance

The transport authority should have the required capability and means to approximate existing and future transport demands and deliberate on the proper policy resolutions that should be made to meet current and future demands. It is essential that the actions of the authority or its agencies satisfy the anticipations of the people. The need for experts and experienced personnel in these sectors is crucial. There is also a need for the existence of an institutional mechanism for partnership and cooperation with other agencies that steer the development and city planning.

8.1.1.2 Objective

The objective is to ensure oversight of the transport authority, which should have the ideal number of qualified professionals who have experience and knowledge, to provide quality, accessible, and safe transport system that meets the needs of all users.

8.1.1.3 Actions and Policy Considerations

Suggested actions and policy considerations follow this section regarding the availability of the required number of professional and other staff.

8.1.2 Investment in Transport Infrastructures

From the discussion, it has emerged that efficient passenger movement and travel time defines a well-managed public integrated transport. Nevertheless, this success factor can be hindered by poor road condition levels that for which it is the case in South Africa.

This mini-dissertation has proven that most of the existing transport modes in the country, due to poor road networks, tend to encourage the expansion of informal transport schemes like the minibus taxis, since they are adapted to existing road conditions.

8.1.2.1 Issues and Importance

It should be noted that improving road conditions and developing efficient public transport goes concurrently with improving mobility for the majority of city dwellers. Presently, road designs in South Africa are unable to accommodate integrated transport. Hence, the government should discontinue the focus on road conditions in the cities and invest in redesigning the roads.

8.1.2.2 Objective

The focus is on the action towards practicable and compatible road designs that complement an integrated transport system is another objective.

8.1.2.3 Actions and Policy Considerations

Some actions and considerations include the improvement of both the condition and designs of South African cities that are to be adopted.

8.1.3 Formalisation of the Informal Operators

Over the past few decades, almost all South African cities have experienced increased rural- urban migration. Accordingly, it is a fact that as urban population increases are not sufficient and efficiently provided for with low-capacity transport; therefore, the mass transit public transport system must be formalised and made as mainstream. South Africa's challenge is involved in incorporating the existing informal public transport system to form a more efficient and practical formal transport system. The best approach would be to reconcile the prevailing informal transport sector with its rewards of minute public investment and flexibility and acclimatise it to a more formal and organised operational system, interchanging with formal high-capacity public transport. For example, other cities should emulate the experiences of Johannesburg, where the formalisation of the informal transport operators/ providers was the basis for managing the application of comprehensive reforms and became a success. Accordingly, such a request will ensure that the conditions for those working in the existing informal transport system will be improved as well as those of the users and will ensure minimisation of externalities and help protect the environment.

8.1.4 Financial Support for Public Transport

Generally, it is quite a task for comparing the informal public transport and the formal public transport in their financial performance based on their business nature.

Also, the external costs caused by either the formal or informal transport are difficult to calculate

8.1.4.1 Issues and Importance

Funding and financing the public transport sector is an important issue for the development of an integrated transport system for South African cities. In essence, a city needs sufficient funding/financing to develop, operate, and maintain the transport system and to implement future projects. Traditionally, budgetary resources are the leading source of transport development funding, and these have repeatedly

failed to meet the requirements for the development of public transit systems to provide adequate infrastructure facilities and/or to upgrade existing facilities. Therefore, in the absence of sufficient funding from traditional sources, there is a need to rally additional resources from other alternatives.

8.1.4.2 Objective

An additional objective is to gather and solicit for funds to upgrade, maintain, and replace existing transport systems and to implement future transport plans with an aim of meeting the present demands and allowing for future transport demands.

8.1.4.3 Actions and Policy Considerations

The recommended actions and policy considerations include the following:

- Reflect on capturing land/rental value appreciation due to major transport projects,
- Consider unconventional funding sources, such as increasing the fuel levy, vehicle registration charge, road fees, or selling infrastructure bonds to supplement the gap,
- Implement integrated public transport projects using a cross-subsidy from other urban development ventures, and
- On a large scale in the transport services, the private sector is to be involved

Therefore, focusing mainly on the public transport affordability does not work in its favour. This means that pricing for travel fares must not be unrealistically low in the formal transport system and denying the operators full compensation for concessionary fares makes them commercially unviable entities. To address this issue, the government should give subsidies or compensation for formal public transport. However, an integrated outline and the starting point are required for the success of the transport sector as a whole. Consequently, financial mechanisms should be formulated with the aim of supporting the system. Also, the inter-modal integration of transport, rather than tolerating profits gained by the informal sector that they pass on the cost burden on the government sector and urban society in general. For that reason, this can be attained through trust funds, affordable credit, and land-value capture that can be

used in uplifting the standards of South Africa's public transport that will, in turn, will economically benefit them.

8.1.5 Public Participation in the Planning Process

8.1.5.1 Issues and Importance

There is a presumption that since urban transport planners and land-use designers have professional experience and understanding regarding planning, they would be better placed deliberate and resolve the best option that can meet the real needs of society in these cities and satisfy them accordingly. However, even with experience in planning, these planners do not understand specific transport needs and the compatibility with their way of life, especially in informal settlements. As such, this is the reason for the importance of public participation in any planning process, as it increases the likelihood that engagements that are undertaken by public agencies reflect the needs of the general public. There are three main reasons for public participation.

- The involvement of all stakeholders, including the general public, is necessary to bring qualitative development in planning and decision-making.
- The public participation to deal with several issues of a crosscutting nature in the planning stage.
- The main constituents of any transport system are those who are using it. Encompassing the public in the decision-making practice avails a healthier opportunity for determining the needs of the general public, especially the disadvantaged group (informal settlement dwellers) because failure to include the importance of social equity remains disregarded.

8.1.5.2 Objective

An additional objective is to embrace a participatory and all-inclusive approach in the planning process using a "bottom up" approach where every stakeholder's standpoint is accorded due importance.

8.1.5.3 Actions and Policy Interventions

The recommended actions and policy deliberations include the following;

- The professional staff should be trained in participating approaches to planning, development, and consultation.
- The development planning and implementation should include all stakeholders. They are the users, and it is on 'their' land that the project will pass through.
- A mechanism should be established for public involvement in the set up of an institutional mechanism for consultation with all significant agencies.

8.1.6 Spatial Planning and Transport

South Africa's large cities are increasingly critical to projections for economic growth and poverty reduction. Accordingly, the United Nations approximates that presently 61.7% of South Africans live in urban areas; this will increase to 71.3% by 2030. However, South African cities continue to face considerable development challenges, including the development of expanding access to essential services. Consequently, there are highly visible, unbalanced environments that segregate poor people from social and economic participation.

8.1.6.1 Objective

The next section discusses the objective to plan all-inclusive spatial planning methods and develop integrated transport systems that take into consideration the poor majority.

8.1.6.2 Actions and Policy Interventions

Fundamental developments that the government must include the following:

- The current population growth is surpassing economic growth resulting in cities, turning into the home of large poor populations. Additionally, backlogs are growing, particularly in access to secure housing with adequate services, and the result is the rapid growth of informal settlements.
- Apartheid configurations of spatial segregation and exclusion remain prevalent to this day where the impoverished communities are still located on the outskirts of the cities where they are forced to make expensive travels gain economic and social services. These settlement patterns weaken

urban economic growth rates because they require large public subsidies for their sustenance and impose variable costs on poor households.

- Public transport and urban land-use patterns are failing urban dwellers and particularly the poor. Present public transport infrastructure, equipment, and local roads are inadequate and in poor condition. Thus, the measure of reinvestment required permitting equitable and sustainable built environment outcomes are beyond the capacity of national government financing alone.
- Spatial planning structures tend to duplicate the status quo, meaning more need for subsidies.
- Poor people in the informal settlements are more likely to be omitted from relevant processes of collaborative planning, as spatial planning approaches to gain the approval the affluent

9. CHAPTER NINE: APPLICABILITY OF THE MINI DISSERTATION TO THE ENGINEERING MANAGEMENT PROGRAMME

9.1 Engineering Management Contribution to Social Development

The need to align infrastructure development and social responsibility is becoming a pre- requisite for all engineers. The engineering sector is required to make decisions that provide sound engineering sense, but that also takes into consideration social fundamentals. In the case of this mini dissertation, many emphases have been placed on researching the social ills that prevent or present challenges regarding advance development for engineers to meet societal requirements. The selected topic presents a full spectrum of engineering challenges that require both financial analysis and the policy shift to provide a comprehensive solution. Engineers are often criticised for trying to separate social demands from engineering practice. This tends to make engineers reactive instead of proactive, and they tend to treat the symptoms that lead to either the formation of informal settlement or lack of public infrastructure as it is presented in this mini-dissertation. Over the years, the engineering profession has been a catalyst for social development. Therefore, it was natural to research and prepare this mini-dissertation after attending the Engineering Management programme and having worked in the transport sector for the past 13 years. This fusion highlighted how engineering principles can help in aligning social needs, social changes, and the requirement for development. The engineering management programme equips engineers with critical management skills to enable them to make the following:

- Researched, informed, and aligned decisions with current trends and by engineering principles;
- Sound financial decisions that take into account social responsibility and accountability;
- Predict future trends by reviewing the past and questioning social trends to come up with new sustainability policy to move society forward;
- Plan for developments, providing the required infrastructure with both financial and social benefits in mind;
- Plan infrastructure projects in alignment with social needs using project management principles;

- Conduct economic studies to justify projects—this assists governments in understanding what subsidies are required and where when it comes to infrastructure development;
- Highlight the not-so-obvious benefits of infrastructure projects that provide solutions towards the removal of informal settlements, which will uplift the community;
- Give direction on the scope of infrastructure projects and their phasing according to priority;
- Conduct statistical predictions and market research to provide enough justification for both financial justification and preparation of the solution as a brand;
- Develop the solution in a similar manner of products are developed and phased.

9.2 Project Management and economic analysis aspects in the mini dissertation

One of the leading solutions for the removal of informal settlements is the provision of a public transport system, which affords society access to places of work, and in that sense creates economic activities. In reviewing the mini dissertation, the view that a mass transit system is a better solution and the assessment of the net results that a passenger rail network yields are demonstrated by the use of engineering management principles and (in this particular case) economic analysis and project management. The way in which the establishment of a viable passenger rail line is done through a detailed feasibility study where the financial and technical analyses are evaluated in detail. These will provide enough knowledge base to make a decision on whether or not the passenger rail network is feasible. The technical, financial, and social benefits of the passenger rail line are assessed to establish the viability for decision-making. The outcome of this will form a guideline in deciding whether or not to invest. In analysing the feasibility of a passenger rail line, the establishment of the population and demographic characteristics must be determined. This is used to profile the passenger users that the rail line will serve. The cost effectiveness of the infrastructure to be developed for the proposed passenger rail line is essential in determining both the financial model and the funding behind it. The analysis also must take into account the social, economic profile of the proposed passenger rail. In the case of South Africa, the net socio-economical benefit sometimes outweighs the cost-benefit outcomes of a pure monetary operational model. This is mainly due to the high employment rate. Part of the examination of the feasibility is to establish the financial benefits of the proposed passenger rail line. This includes the

revenue collection versus the operational and maintenance costs over the period of a passenger rail line lifespan. The technical evaluation of a passenger rail network is an exercise where physical infrastructure feasibility is determined. Alternative rail alignments are checked, and these are done through the physical design of the rail alignment compared to all the different stations and with the examination of each station demand analysis. Once all the comparisons are completed, a scorecard with various criteria that are given a weighting value will determine the best alternative when compared. The scorecard criteria include the following:

- The best catchment area in regards to the demand analysis,
- The most cost-effective alternatives,
- The alternative that has the least environmental infringement, and
- The alternative to the best geometric design, which yields the best rider comfort for passengers.

The engagement with different stakeholders that are impacted by the passenger rail line ensures that there is an integration of all other proposed developments in the area and that there are no conflicting intentions by different stakeholders. The selected alternative is further developed and assessed through a particular passenger demand analysis. The passenger demand analysis is to establish the number of users of the system and to determine the level of operation and maintenance that is required by the passenger rail for its lifespan. The full cost of this alternative is derived, and from that an economic benefit analysis is confirmed, after which the net benefit return of the selected alternative can then be computed, which gives a full picture of the capital expenditure required and the operational cost over the lifespan of the passenger rail network. Once this information is available, it gives a full indication of whether or not this system is affordable. The outcome of the feasibility of the passenger rail network is in the demand analysis, the technical, and the economic assessment of the alternatives considered, the operational requirements, the required capital investment and operational and maintenance planned for the lifespan of the passenger rail network.

9.2.1 Market Analysis

The viability of the passenger rail network system is greatly reliant on the market that it will serve; it is critical to establish the potential market that the rail network will serve. This will be set in the form a market analysis. The market analysis takes into consideration the area in which the intended passenger rail system will serve, the region's economic characteristics, current travelling trends, and the aspirations and future development of the area. The first step is to identify the area in which to conduct the market analysis. The identification of the area is done through the assessment of area maps, the review of township demarcations, and the establishment of studies that have been done in the area in regards to development plans. Once the market analysis is done, the next phase is the computing of the passenger rail network demand.

9.3 Method of Computing Demand Analysis

The demand analysis is determined to justify the passenger numbers for a particular rail system. The demand analysis is computed by taking an area allocated for a housing development of units up to 25,000, if an affected area of a 1 km radius of the above area covers up to 10% of that development, the actual number of housing units that will contribute to the station patronage will be about 2,500. According to the Stats SA, the demographics of the South African township are that in an average household has four dwellers that will use public transport. The total public transport users for the affected area is 2,500 times four, If (according to the Statistics South Africa) a public transport share in the total transport is 20%, and of the 20% rail share in the public transport is 40% of that, then the community number that will be used for the rail will be ((10,000 x20%) x 40%) estimated at 800.

9.4 Responsibility for Engineering Managers in Moving Forward

In moving forward, the engineering practice needs to lead in areas of development. Development is one fundamental economic catalyst that serves to promote both social advancement and service delivery. The use of all the engineering tools presented in the engineering management programme has contributed to a better understanding of society's shortcomings. To develop solutions these following tools are used:

- The research methodology used when establishing the problem statements identified in this mini-dissertation;
- The economic analysis that evaluates the current policies and provide a way forward;
- Derive the market analysis to justify the feasibility of a selected solution;
- Reviewing and questioning policies and trends;
- The main tool is the importance of taking social deformations and solving them using engineering principles that, in this mini-dissertation, have been proven to be successful.

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