# Public transport network improvements as a catalyst for integrated land use-transport development: Lessons from case studies of Copenhagen, Curitiba, Hong Kong and Seoul

A minor 60-credit dissertation submitted in partial fulfilment of a Master of Philosophy specialising in Transport Studies

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**DECLARATION**

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## ABSTRACT

### Background

Challenges in the provision of public transport services in South Africa prompted the government to transform the public transport system during the mid-2000s. This led to the development of the Public Transport Strategy and Public Transport Action Plan in 2007. This resulted in the implementation of Bus Rapid Transit (BRT) systems in various cities, such as Johannesburg, Cape Town and Tshwane. Another notable public transport project was the implementation of the Gautrain rapid rail transit project.

The BRT systems in South Africa have faced many implementation and operations challenges. These challenges include low ridership and difficulties in covering operating costs. The intentions of an integrated public transport system have, therefore, not been fully realised.

### Aim

This study aims to identify characteristics of four case cities before and after the implementation of their BRT or rail transit systems, focusing on land value capture, transit-oriented development, land use patterns, and travel behaviour. This includes presenting information related to planning and institutional arrangements, financial and operational arrangements of the systems. It is hoped that lessons can be learnt from these case study cities and be applied to the South African context.

### Method

Cumulative multiple case studies were conducted in the cities that had implemented BRT (Curitiba and Seoul) and the cities that had implemented transit rail systems (Copenhagen and Hong Kong). Qualitative information was collected from online documents, including journal articles, academic research reports, information from organisational websites, internet information, and online newspaper articles. Based on the information collected, a synthesis matrix was then created, which captured the similarities and differences of the case studies under different themes and thereafter identified lessons learnt.

### Findings

One main similarity in these case studies was political involvement before the implementation of the projects, while one of the main differences was the different funding mechanisms used to implement these projects. The four case studies showed that successful implementation of their projects entailed a large-scale implementation of the public transport network improvement project. In other words, a citywide public transport network serves as a catalyst for integrated land use-transport development.

### Conclusion

This research study concludes that political involvement, stakeholder engagement, funding framework, and implementation of a catalytic project for integrated land use-transport development at a large scale are crucial for successful implementation of different phases of BRT or rail transit projects.

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# 1. INTRODUCTION

## 1.1 Background of the research

South Africa held its first democratic elections in 1994 after many years under apartheid. According to the South African Cities Network (SACN) report of 2016, apartheid was based on racial segregation, control and socio-economic marginalisation of Black people. This resulted in Black people establishing homes outside the periphery of cities after forced removals during the 1960s and transport being available only during certain times of the day (morning and afternoon) as a way of access control. Moreover, this period also favoured the construction of road infrastructure for private vehicles, and there was low investment in public transport and non-motorised transport (SACN, 2016: 49).

The first democratic elections in 1994 brought hope to many Black South Africans, and there have been drastic changes in the landscape of the urban areas. Access to healthcare and education, investment in low-cost housing, public transport infrastructure, and water and sanitation have been achieved over the past three decades, but at different levels. Housing took a different format, wherein property developers started building estates and townhouses outside towns and cities. This has led to continued spatial fragmentation, and access to these areas is mostly through private vehicles with limited public transport in the form of minibus taxis and municipal buses. Some of these buses are only available in the morning and afternoon to bring workers from local townships to these areas. The SACN report (2016: 53) describes these new property developments as “new cities” that have led to spatial and social exclusion, segregation, and inequality based on class or income.

Challenges regarding the provision of public transport services in South Africa resulted in the need for the government to transform the public transport system during the mid-2000s. This led to the Department of Transport developing a Public Transport Strategy and Public Transport Action Plan in 2007. The Public Transport Strategy consists of two key thrusts, which are Accelerated Modal Upgrading and Integrated Rapid Public Transport Networks (Department of Transport, 2007:3). According to the Department of Transport (2007:12), the first pillar is about improvement of the current public transport networks and the second pillar is about “implementing high-quality integrated mass rapid public transport networks”.

The second pillar led to the implementation of BRT systems in various cities, such as Johannesburg, Cape Town and Tshwane. Besides the BRT systems, another notable public transport project is the Gautrain, which is a rail transport service of the Gauteng Department of Roads and Transport. Gautrain began providing its services in June 2010, just before South Africa hosted the 2010 FIFA Soccer World Cup. Literature has shown that the Gautrain brought significant land use changes in the cities of Johannesburg and Tshwane.

Notwithstanding the huge investments made to overhaul the public transport system in South Africa, the SACN report of 2016 raised concerns about an increase in the use of private cars and minibus taxis. The increased usage of taxis, even though they are

usually more expensive compared to public transport, has been exacerbated by the fact that taxis can collect passengers anywhere. They are known as presenting “the most responsive transport option compared [to] dispersed spatial landscapes” (SACN, 2016:70). Also, the BRT systems faced challenges with regard to implementation and operations. The market share of the BRT system has been low, in such a way that it becomes difficult for cities to cover the operating costs of these systems. The intentions of an integrated public transport system across all three levels of government have not been fully realised. One of the challenges has been the incomplete public transport network improvements, which has delayed the implementation of BRT systems.

On 26 July 2022, the then Minister of Transport, Mr Fikile Mbalula, gave feedback on progress made in restoring commuter rail services and rehabilitating and upgrading rail infrastructure. This forms part of the construction and recovery of the commuter rail corridors in South Africa, which were left in bad condition due to theft and vandalism.

Over the years, various countries, both developed and developing countries, implemented BRT and rail transit systems to improve their public transport systems. These projects have been implemented for various reasons, including achieving different objectives for their respective countries. Cities such as Copenhagen, Curitiba, Hongkong, and Seoul implemented either BRT and/or rail transit systems some years ago within their respective cities. Case studies on the implementation of the above systems have been published and have produced invaluable lessons on issues of urban form, land use development and transport planning, and institutional and operational arrangements. Study tours have been undertaken by officials from different government levels in South Africa in the past before the implementation of the BRT systems.

It should be noted that the Word Bank conducted a study in 2012 on “the Soft Side of BRT: Lessons Learnt from Five Developing Cities” (Kumar, Zimmerman & Agarwal, 2012:2). In this study, case studies on BRT projects were discussed in detail by looking at the following issues: Geographic, Economic, Demographic, and Transport contexts of the project; Political, Governance, and Planning Background; Communications; System Concept, Integration, and Performance; Operating arrangements; and Financial arrangements of the projects to identify these lessons.

As stated above, the continued car-dependent sprawl and incomplete public transport network improvement in South African cities have made it difficult for the cities to fully introduce integrated land use transport development. The case studies of Copenhagen, Curitiba, Hongkong, and Seoul have revealed that the relationship between land use development and transport development has been more complementary and better integrated with respect to how developments were planned in these cities. Based on the above case studies, South African cities can learn how they can better integrate land use and transport development for the successful implementation of their respective public transport systems.

## 1.2 Aim of the research

This research aims to gain an understanding of changes that have been made by the implementation of the BRT and rail transit systems in urban form, land use patterns, and development. In other words, the research aims to identify characteristics of cities before and after implementation and the impact of the implementation of the system in terms of Land value capture, Transit-Oriented Development, and Land use patterns. This will also include background information related to planning and institutional arrangements, as well as financial and operational arrangements of the system.

The significance of this research is a better understanding of and insights into how South African cities can improve their respective public transport projects that have been developed and/or are under development to facilitate integrated land use-transport developments, which will be beneficial to citizens while promoting socio-economic growth and development. This research adds value to the field of integrated land use and transport planning and development, wherein South African cities are still battling with challenges related to implementing financially sustainable and practical implementable BRT and rail transit projects, which has a unique political and economic history.

The lessons from these case studies could assist South African cities in how to approach the impact of implementing the BRT and rapid rail systems. It is proposed that Copenhagen, Curitiba, Hongkong, and Seoul be used as case studies for this research to address the questions that are raised below in 1.3. The rationale or justification for selecting these case studies is provided in Chapter 3.

## 1.3 Research questions

The research questions for this study are provided below as follows:

What were the planning and institutional arrangements for public transport before project implementation?

i. What were the planning and institutional frameworks?
ii. How did these frameworks facilitate the implementation of the project?

What was the nature of the transport investment?

i. Who was the project sponsor?
ii. How is the investment structured?
iii. Are there any loan payment arrangements?

What are the operational arrangements of the system?

i. Who is the operator of the system?
ii. What are the roles and responsibilities of the operator?

What has been the impact of the implementation of the system in terms of

a.

i. Land value capture;
ii. Transit-Oriented Development; and
iii. Land use patterns?

b. What has been the impact on travel behaviour after project implementation?

What are the measures adopted to attract land use developments to desired locations and to discourage land use developments from undesirable locations?

## 1.4 Chapters outline

This minor dissertation is divided into nine chapters, which include the Introduction (Chapter 1). A brief description of the eight chapters is provided below.

Chapter 2 is the Literature Review, which briefly discusses work that has been done in developed and developing countries on BRT and rail transit systems implementation to assist in the selection of cases for more detailed work in later chapters.

Chapter 3 is the Research Methodology that was used to collect data to answer the questions that were posed in Chapter 1 of this study.

Chapter 4 discusses the Copenhagen case study by addressing research questions related to the Copenhagen Metro implementation.

Chapter 5 discusses the Curitiba case study by addressing research questions related to the Curitiba BRT implementation.

Chapter 6 discusses the Hong Kong case study by addressing research questions related to the Hong Kong Mass Transit Rail (MTR) implementation.

Chapter 7 discusses the Seoul case study by addressing research questions related to the Seoul BRT implementation.

Chapter 8 discusses similarities, differences, and lessons that can be learnt by South African cities from the above four case studies.

Chapter 9 is the Conclusion and Recommendations of this research study.

# 2. LITERATURE REVIEW

## 2.1 Introduction

The purpose of this chapter is to review work that has been done in developed and developing countries on BRT and rail transit systems implementation to assist with the selection of case studies for more detailed work in later chapters. This will be done by first looking at the context of the events that led to BRT implementation in two South African cities, namely Johannesburg and Cape Town. It will then discuss the Gautrain implementation to understand rail transit implementation in South Africa. This will be followed by examining BRT and rail transit implementation in cities from Africa, Europe, Asia and North America to understand the implementation of transit systems projects in their respective cities. It is hoped that the above review will provide a background to conduct detailed case studies on BRT and rail transit systems in later chapters of this research study.

## 2.2 South Africa

Besides the BRT projects in various cities, another notable public transport project in South Africa is the Gautrain, which is a rapid rail transit system of the Gauteng Department of Roads and Transport. Gautrain started operating on 8 June 2010, just before the start of the 2010 FIFA World Cup. However, at that time, its operations were limited to the Sandton to OR Tambo International Airport route. It provided its full service from 7 June 2012.

Taking a step further back, the early 2000s to mid-2000s in South Africa was a period when delegates from South African cities embarked on South American tours to visit countries that had already implemented BRT systems to gain insight and knowledge on how to implement BRT in their respective cities. The sections below provide brief discussions on the BRT systems developed by Johannesburg and Cape Town, and Gautrain, which is a rapid rail transit system.

### J**ohannesburg: BRT**

Rea Vaya was funded by the National Treasury through a grant known as the Public Transport Infrastructure and Systems Grant (PTISG), which is transferred by the Department of Transport to municipalities that are embarking on such projects in their respective municipalities (Allen, 2013:12). It is estimated that R1.6 bn was spent on Phase 1A of this project. Phase 1A of Rea Vaya started its operations on 30 August 2009 and links Johannesburg Central Business District (CBD) and Braamfontein with Soweto.

It was reported in the Citizen (n.d.) that Phase 1C of the Rea Vaya project would be completed in 2024, following delays, among them the COVID-19 pandemic, which hit South Africa between 2020 and 2022, and resulted in the closure of construction of infrastructure projects for some time (approximately three months) during the nationwide lockdown. Regulations were later gradually relaxed for such projects to resume.

As part of BRT planning and implementation, the City of Johannesburg visited BRT systems in Bogota and Guayaquil in August 2006, and the delegation consisted of politicians, city officials, representatives from two bus companies and the two largest minibus taxi associations (Wood, 2014:2661). In 2007, Johannesburg city undertook a second visit to Bogota and Pereira. According to Wood (2014:2662), the second tour included a diverse group of delegates, and some of these delegates were informal operators who had a chance to discuss their concerns with the Bogota operators who had once been informal operators before the implementation of the BRT system in Bogota. These talks enabled the Johannesburg operators to reconsider their situation (Wood, 2014:2662). It may be concluded that these talks made operators understand that such proposed changes in the public transport system had happened before in other cities and had resulted in positive changes, which benefited them.

The then Member of the Mayoral Committee (MMC) for Transport, Ms Rehana Moosajee, was of the view that the reason the implementation happened “as quickly or as quietly” as it did was because the delegates, including participants from the taxi and bus industries, were willing to learn about the BRT system during the Bogota study tour (Wood, 2014:2663).

The above-mentioned study tours made it possible for the city to go ahead with the implementation of Rea Vaya without any hurdles or protest actions, which are sometimes inevitable in South Africa when the government implements big infrastructure projects in the transport sector. Without the early buy-in, it would have been difficult to convince the affected taxi operators to support this project.

TOD involves formal development of areas around public transport stations. The characteristics of TOD are mixed used development close to transit stations, thus encouraging people to walk to reach their places of work and other social services, and also accessing public stations.This could be achieved for example by developing residential and commercial areas very close to bus stations, thus enabling people staying and working in these areas to walk to bus stations when traveling to other areas.

Harrison and Rubin (2020:256) explain Transit-Oriented Development (TOD) as follows:

> With its claims to provide high-quality transit, a vibrant mix of land use, lower carbon emissions, social integration, and pedestrian-friendly design, Transit-Oriented Development (TOD) promises advantages that may seem universal in appeal.

The above excerpt may look as if TOD is easy to achieve, but this is not the case, as has been witnessed in the City of Johannesburg. It is worth noting that this concept has mostly been widely used in developed countries, and to apply it in a developing country such as South Africa would obviously come with its own challenges.

The change in the political landscape at local level had a negative impact on TOD due to different political priorities pronounced by mayors from different political parties (ANC and DA) of this city (Harrison and Rubin, 2020:258). What started on a high note during Amos Masondo’s tenure as the mayor ended up on a low note when Herman

Mashaba took over as the mayor of Johannesburg. According to Harrison and Rubin (2020:258), Mayor Masondo came up with “spatial priorities in the inner city, Soweto and Alexandra”. In preparation for the 2010 FIFA World Cup, he made the plan to include TOD development along new transit systems: “the provincial government-initiated rapid rail network (the Gautrain); and the city-initiated BRT system (Rea Vaya)” as reported by Harrison and Rubin (2020:258). It should be noted that at that time DA, as the opposition party, was also in support of these TOD Plans.

In 2013, Parks Tau (ANC member) took over from Amos Masondo as the mayor, and he introduced the Corridors of Freedom (CoFs). Harrison and Rubin (2020:258) explain that during this period:

> The initial focus was on investments in visible improvement along the corridors, such as bicycle lanes, pedestrian walkways, bridges and parks, but there was also increasing investment in the bulk infrastructural capacities – water, power and storm water – to support increased densities along the transit routes. Increased densification is a keystone of TOD approaches across the world, and the CoJ was very aware of Johannesburg’s relatively low densities and the potential that densification offered in terms of transit thresholds, compaction and socio-spatial inclusion.

According to Harrison and Rubin (2020:258), the CoF was a major project, which was led by the planning team and the Johannesburg Development Agency (JDA). This project came with a huge budget for implementation, and other departments and entities were expected to align their budgets to this project (Harrison & Rubin, 2020:258).

Herman Mashaba, from the DA at the time, succeeded Parks Tau as the Johannesburg mayor in 2016. Harrison and Rubin (2020:259) state that Mashaba’s speeches hardly mentioned the CoF but only mentioned “spatial marginalisation of poor people, public transit hubs in the townships, and a programme for inclusionary housing”. This was despite the fact that the CoF continued to feature in the city’s planning document. By 2018, the CoF was changed to ‘Transit-Oriented Corridors’ (Harrison & Rubin, 2020:259). It should be noted that most projects that were planned under the CoF were never realised after the DA administration took over (Harrison and Rubin, 2020:259). More emphasis was put on service delivery projects with the support of the EFF in a move to invest more money in townships (Harrison and Rubin, 2020:260). One can attribute the above to a change in a political mandate, and this is common when a different political party comes into power, as the party in power would normally favour projects that support its mandate. The success in the implementation of the CoF needed a strong political will, and this was not there after the DA took over from the ANC. This could be expected as CoF was an ANC initiative and not the DA’s. Without stakeholder support, in this case, political support, some projects are likely to fail or experience delays in implementation.

Besides the above political situation within the municipality, a human settlement initiative from the Gauteng Provincial Government also had a negative impact towards the implementation of the CoFs since “these two initiatives had very different spatial logics and were effectively in contradiction” as explained by the then Premier of Gauteng, Mr David Makhura (Harrison & Rubin, 2020:261). The political situation refers to change from ANC mayor to DA mayor which resulted mostly in the non implementation of projects that had been proposed by ANC.

With the failure of the implementation of the CoF in Johannesburg, it is hoped that the addition of Rea Vaya stations to form part of Phase 1C in Sandton, which already has a Gautrain station, will have a positive impact on the TOD approach in Sandton and surrounding areas.

**Cape Town: BRT**

The then Mayor of the City of Cape Town, Hellen Zille, held the first discussions on BRT in 2007 (Boulle and Van Ryneveld, 2015:6). The City of Cape Town later undertook the South American trip in 2007 and 2008. According to Wood (2014:2663), the Cape Town delegation, consisting of politicians, city officials, private transport companies and consultants, visited Guayaquil and Quito, Ecuador; Bogota and Pereira, Colombia; and São Paulo, Brazil with the aim of learning about BRT. Unlike the City of Johannesburg delegation, this delegation did not have representation from the bus, rail or minibus industry.

One of the highlights of this tour was a visit to Bogota, where the delegates rode the major corridors of TransMilenio (Bogota BRT system) and attended a two-day conference on TransMilenio (Wood, 2014:2663). Furthermore, the delegation got a chance to travel on local BRT systems of other cities and met with transport officials involved in the implementation of these systems, as stated by Wood (2014:2663). Wood (2014:2663) reported that the City of Cape Town was able to contact various experts after their South American study tour due to networking that took place during the visit.

The City of Cape Town named its first BRT system MyCiTi, which they also refer to as an integrated rapid transit system. According to Boulle and Van Ryneveld (2015:1), MyCiTi started its operations in May 2010, before the 2010 FIFA World Cup, and their operations formed part of transport arrangements for this event in Cape Town. At the time, services were provided based on interim contracts with previous taxi operators to run them. Funding for MyCiTi was also through the PTISG, which at the time was funding all municipalities that were embarking on such projects in their respective municipalities. Then, in October 2013, the City of Cape Town “signed 12-year contracts with three companies to provide” operational services for Phase 1, as explained by Boulle and Van Ryneveld (2015:5). Also, it is encouraging to note that two out of the three companies that were involved in the first operations came from the previously informal taxi operators.

Boulle and Van Ryneveld (2015:4) reported that the total capital investment for Phase 1 was around R5.786 billion. About R800 million was paid “to buy out” the operating licences of the previously informal operators who ended up being formal Rea Vaya operators, as mentioned above. This was also to “capitalise [on] the new vehicle operating companies”.

According to Miller (2018:46), the approval of Phase 2 of this project with a construction period estimate of 15 years was granted in 2017. The aim of this phase

is to link the city with “poorer neighbourhoods in the periphery of the city”, and Mitchells Plain and Khayelitsha are part of this phase, as indicated by Miller (2018:2).

Another important factor to note during these processes is that there was active participation of the government at all three levels, with the City of Cape Town taking the lead when it came to the actual implementation of Phase 1. The Department of Transport played a crucial role in this project by providing the funding, as indicated by Boulle and Van Ryneveld (2015:22). Without this funding, it would not have been possible for the city to implement such a huge project.

It may be concluded that study tours that were undertaken by the city also helped the city realise the need to involve the informal public transport industry to ensure the successful implementation of this project. The same can be said for Rea Vaya in Johannesburg, as discussed above.

Miller (2018:3) indicated that the city took a decision to implement TOD during Phase 2:

> Although still relatively in its infancy, Phase 2 of the MyCiTi BRT project represents the perfect opportunity for the CoCT to apply the principles of TOD on a larger, more concrete scale. This brings the notion of whether TOD combined with BRT can change Cape Town’s built environment for the better.

Miller (2018:40) raises the point that the city had not planned for TOD in Phase 1 since it had not yet adopted TOD at the time. However, the lower ridership levels than anticipated during Phase 1 forced the city to look at ways of improving these ridership levels to reduce operational expenditure, which could not be covered by revenue generated from the operations. According to Miller (2018:41) the city has had to rely on subsidies and grants to cover these costs in the past years. As a result of this, the city identified TOD as one of the approaches that could help to increase ridership levels of MyCiTi during Phase 2 implementation.

**Johannesburg and Tshwane: Rapid rail transit (Gautrain)**

The Gauteng Provincial Government (GPG) decided to implement the Gautrain project, which is a rail transit system currently operating between Johannesburg and Tshwane, and between Sandton and OR Tambo International Airport.

Bombela Concession Company (Bombela) signed a Concession Agreement (CA) with GPG “to design, build, operate, maintain and partially finance Gautrain rapid rail project” (Bombela Concession Company, n.d.). In other words, the Gautrain project is based on a public-private partnership (PPP) model, with the public partner (owner and main financier of the project) being GPG and the private partner (developer and operator of the project) being Bombela.

The Gautrain Management Agency (GMA), an agency of the Gauteng Department of Roads and Transport, is responsible for the management of the Gautrain. According to GMA (2022:8), their mandate is to ensure that the “Gautrain System operates in a sustainable manner with a clear commitment to governance and the primary economic objectives of the GPG”. Among others, GMA’s functions include asset and financial management; promoting cooperation between all three spheres of government;

assistance with regard to the implementation of the Gautrain, ensuring integration between Gautrain and Public Transport Plans, transport services, and providing monitoring and oversight of the Gautrain project (GMA, 2022:15).

Gautrain (rapid rail transport system) is the first of its kind "to be implemented in South Africa", as reported (GMA, 2015:2). According to the GMA (2022:15), Bombela "holds a 19½-year concession for the construction, operation and maintenance of the Gautrain", and this CA is expiring in 2026.

As explained by GMA (2022:15), the focus of GMA is to:

> Manage, co-ordinate and oversee both the operation and maintenance of the Gautrain and the implementation of the expansion of the System and extension of rapid rail to accommodate future demand and new services as identified in the Integrated Transport Master Plan (ITMP25) for Gauteng.

It became clear during the preparation of the Feasibility Study and Financial Model that the Gautrain project would need financial support from the government during the Development Period and Operating Period. This meant that for the Development Period, the government had to pay the remainder of the capital required, which was the difference between the total capital requirement and the private sector contribution. The government financial support was through the Department of Transport and GPG. A total amount of R25.2 bn was therefore contributed by the government to fund the Development Period. The Operating Period had to also be funded by the government, and this was in the form of a Patronage Guarantee. This payment depends on the performance of Gautrain. According to GMA (2022:26), GPG is expected to pay a Patronage Guarantee to Bombela if revenue received by Bombela through Gautrain operations is less than the Minimum Required Total Revenue (MRTR). In other words, an increase in ridership would mean less Patronage Guarantee from the government; and this is what GMA strives for, and it forms part of its output indicators. The Patronage Guarantee is paid by GMA monthly, as per the CA.

According to GMA (2022:68), there were plans to extend the Gauteng Rapid Rail Integrated Network (GRRIN) by adding 148km and 19 stations in 5 phases. Phase 1 was planned to be an extension from "the existing Marlboro Station to a new station and maintenance depot facility at Little Falls on the West Rand, including an upgraded Sandton Station as well as additional stations at Randburg and Cosmo City" (GMA, 2022:68). With the planned extensions, it would be interesting to get an understanding of the impact on land value, Transit-Oriented Development (TOD), land use patterns and on travel behaviour after the completion of these extensions.

In a study conducted by Arnold, Le Roux and Hattingh (2015:186), TOD is defined as:

> …compact development within close walking distance of transit stations. Development around the stations is mostly of concentrated moderate to high-density housing typologies along with public uses and services, and retail in mixed-use developments located at strategic points along the regional transit system. TOD policy generally makes use of mass public rail-based transit to influence mixed-use private and/or institutional development.

When one takes the Sandton Gautrain station, for example, the number of property developments next to the station has increased over the past 10 years, with some big companies such as Old Mutual and Sasol relocating their Headquarters near the

station. There are two Old Mutual offices in Sandton. One of these offices is the Old Mutual Place, which is situated just 2 minutes away (when walking) from the Sandton Gautrain station. The mixed development use in Sandton next to the Gautrain station resembles a typical TOD in a country such as South Africa, which had to adapt the transit systems to its environment. The banking, retail and hospitality industries have ensured that they are located close to the Gautrain station in Sandton for ease of access by their customers and employees, with other forms of public transport services such as Rea Vaya and minibus taxis near this station.

Land value capture refers to the way in which the government can charge taxes or fees to property owners and developers, and the revenue generated from these taxes or charges can then be used in the development of the area. Land value capture puts an emphasis on the value of the land and uses this value to attract potential buyers and developers to the land in exchange for money in form of taxes or charges. In the case of transport, this can be done by improving public transport infrastructure, facilities or services within a specific area. According to Lombard, Behrens and Viruly (2017:460), it may seem that there has not been much consideration of value capturing in South Africa. However, Lombard, Behrens and Viruly (2017:471) confirmed an increase in property values to developments close to the Gautrain stations with the possibility of looking into value capturing mechanisms. The above was concluded in the study of the Gautrain project, which investigated value creation and capture in the context of transport infrastructure investment for the Gautrain.

Land use patterns refer to the way in which land is used in a particular geographical area. Land can be used for different purposes such as agricultural, commercial, residential and industrial uses. It can be expected that land use patterns will change in the future, especially considering the development and the implementation of a massive billion-rand project such as the Gautrain project. With regard to the Gautrain project, “the integration of land use with public transport planning” was seen as being part of Gauteng’s 25-year Integrated Transport Master Plan (ITMP25) (GMA, 2022:7). Another project of note that was implemented is the Smart Driving Licence Testing Centre at the Midrand Gautrain Station in January 2022 by the GMA (GMA, 2022:7). Furthermore, the Gautrain project has led to other developments within the vicinity of the Gautrain station. Based on the above developments, MEC Mamabolo saw the Gautrain as “a catalyst for growth and development” in the Gauteng province (GMA, 2022:7).

## 2.3 African cities

### Lagos: BRT Lite

Lagos is the largest city in Nigeria and is the first African city to have a fully operational BRT Lite in 2008 (Otunola, Kriticos & Harman, 2019:3). This was before the introduction of the first BRT in South Africa in 2010. Lagos’ BRT is known as a BRT Lite as it does not have characteristics that make it a standard BRT such as exclusive BRT lanes, advanced technology, raised platforms, and pre-boarding fares, as alluded by Otunola, Kriticos and Harman (2019:6).

Lagos was pressurised to improve the quality of its public transport system and accommodate the growing population demand for public transport services as it is one of the fastest-growing cities, as alluded by Otunola, Kriticos and Harman (2019:3). The introduction of BRT Lite was one of the projects to address the need for improving public transport services in this country to accommodate a high demand for an efficient public transport service. The BRT was part of the large-scale infrastructure and public transport projects implemented by the Lagos State Government. In the Lagos State Development Plan (LSDP 2012–2025), multifaceted infrastructure challenges in Lagos are highlighted, specifically inadequate social and physical infrastructure owing to high population growth, a shortage of water and “erratic power supply”, as well as housing (Oyalowo et al., 2024:284).

In 2009, the BRT Lite network was reported to be approximately 35,5 km long with a ridership of 350 000 commuters per day (Oyalowo et al., 2024:293). According to Oyalowo et al. (2024:285), the operations of the BRT Lite are managed by a private company called Primero, with operations in this company starting with 434 buses. This was followed by the introduction of a new bus service called Lagos Bus Services Limited (LBSL) in 2019, which “operates a fleet of 820 buses [520 are HOVs and 300 are midi-buses]”, as reported by Oyalowo et al. (2024:285). HOVs refer to High Occupancy Vehicles, which are permitted to use dedicated HOV lanes, while other vehicles are prohibited from using HOV lanes.

Even though other modes of transport, such as those by rail and water, are available, these modes are currently underutilised, with the citizens of Lagos relying more on road transport, which includes informal minibuses known as danfos, public transport buses and private cars, and non-motorised transport (NMT) such as walking and cycling, as alluded by Oyalowo et al. (2024:284).

With regard to institutional arrangements, the federal government and the State are responsible for the regulation and management of transport in Lagos. Otunola, Kriticos and Harman (2019:9) gave a detailed narrative of the public transport reforms undertaken by the Lagos State Government between 2000 and 2019, which included the establishment of two agencies. The first agency that was established is the Lagos Transport Management Authority (LASTMA) in 2000. This agency is responsible for traffic law enforcement and compliance within the city as reported by Otunola, Kriticos and Harman (2019:8). In 2002, the Lagos Metropolitan Transport Authority (LAMATA) was established and its main function was transport policymaking and overseeing transport-related projects in Lagos, as alluded by Otunola, Kriticos and Harman (2019:9). LAMATA worked closely with the World Bank to develop the first Strategic Transport Master Plan (STMP) for Lagos in 2005. Study tours were also conducted to developing cities between 2006 and 2007. These tours enabled all stakeholders to learn from the experiences of other developing cities regarding BRT implementation in their respective cities. The city launched the BRT Lite in 2007 and it became fully operational in 2008. The main purpose of the BRT Lite was to “ameliorate the negative consequences of the disorganised, fragmented, costly, unsafe, and unreliable transport system”, as alluded by Otunola, Kriticos and Harman (2019:9). Infrastructure investments and regulatory reforms were undertaken between 2008 and 2017. This was followed by a Bus Reform Initiative between 2017 and 2019, which was aimed at improving capacity and customer experience by the introduction of HOVs to replace

the danfos, which included training drivers who had previously been danfo drivers to drive the HOVs and midi buses, improvement of the transport infrastructure, and improved information collection and dissemination (Otunola, Kriticos & Harman, 2019:17). The expansion of the infrastructure included the completion of remaining BRT corridors, road and junction improvement works, construction of bus shelters, stations and depots as alluded by Otunola, Kriticos and Harman (2019:17).

It should be noted that the above reforms were fully supported by politicians and top government officials. This included the financing of various projects by government. LAMATA fulfilled its key role by ensuring coordination between all major stakeholders in the transport sector as alluded by Otunola, Kriticos and Harman (2019:10).This ensured successful implementation of various projects, including the BRT Lite. As an example, Otunola, Kriticos and Harman (2019:10) point out that inter-agency stakeholder management by LAMATA resulted in the successful implementation of the BRT Lite. This project involved working together with the following government departments, namely the Ministry of Physical Planning and Urban Development (responsible for land acquisition matters), LASTMA (responsible for traffic law enforcement and regulations), and the Ministry of Public Works and Housing (responsible for transferring the infrastructure to be used for BRT to LAMATA, financing and construction of the BRT infrastructure), as pointed out by Otunola, Kriticos and Harman (2019:11).

The role played by the two semi-informal organisations in public transport is also big. The danfos are owned by the Road Transport Employers Association of Nigeria (RTEAN). The National Union of Road Transport Workers (NURTW) is responsible for the operations of the danfos (Oyalowo et al., 2024:285). Based on the above, the Lagos State Government has also ensured that RTEAN and NURTW are “part of BRT Lite and LBSL through a franchising model”, as alluded by Oyalowo et al. (2024:285). LAMATA played a critical role in ensuring buy-in from the informal operators. The operators were also part of the study tours to Curitiba and Bogota, and through these tours, the operators experienced BRT implementation at first hand, including the involvement of the previously informal operators in the respective cities (Otunola, Kriticos & Harman, 2019:13). This led to the implementation of the franchising model, as mentioned above. The above also shows alignment with the decisions taken by informal operators from other developing countries who later on became involved in the operations of BRT operations in their respective cities after persuasion by government.

It is also encouraging to note that the Lagos State Government has been at the forefront of ensuring that the above franchising model is successful by becoming a financial guarantor for NURTW, which needed to secure private funds for buying and operating HOVs as indicated by Otunola, Kriticos and Harman (2019:12). The successful operation of the HOVs on the BRT Lite lanes allowed the NURTW to pay back their loans within two years of operations, as alluded by Otunola, Kriticos and Harman (2019:12). As an example, the integration of the public transport system in Lagos has seen the incorporation of the informal danfos into the public transport system, with their drivers being offered formal driver training and providing feeder services in areas where the BRT Lite is not operational as explained by Otunola, Kriticos and Harman (2019:13).The Lagos State Government has ensured continuous stakeholder engagements even through change in political leadership, which has

resulted in strong community support and involvement. It can, therefore, be concluded that the changes in political leadership has not affected the public transport reforms in Lagos.

According to Otunola, Kriticos and Harman (2019:12) the first phase of the BRT Lite was funded by the Lagos State Government, which was followed by developmental funding from the World Bank and AfDB, who provided State loans for funding the second phase of the BRT in Lagos.

The Lagos State Government has also initiated projects to promote integrated transport within the city. This includes a rapid transit rail known as the Blue Line, Lagos Metropolis Mass Transit Train Service and ferries, which are mostly privately owned and operated (Oyalowo et al., 2024:293).

According to Nubi et al. (2024:44), the Lagos State Government does not have concrete plans of introducing TOD in Lagos as there is no strategic linkage between transport and housing plans. Nevertheless, the Lagos State Government has implemented housing projects to address housing shortages within the city, such as "the Lagos HOMs, which are designed as a mixed density housing with one-, two-, and three-bedroom apartments in various locations across the city" and "other housing projects aimed at improving housing accessibility within the city" (Nubi et al., 2024:46). Based on the above, it may take some time for Lagos to be in a position to commit to TOD.

**Nairobi: BRT**

Nairobi is the capital city of Kenya and is the largest city in Kenya. Nairobi is one of the cities in Africa that has a very complicated political and economic history, which has somehow delayed public transport reforms that were proposed in the early 1973, as alluded by Klopp, Harber and Quarshie (2019:17). A proposal was put forward in 1973 to establish a Nairobi Transport Authority, but it was never implemented.

The collapse of the public-run bus services in Nairobi was reported in the early 1990s. These bus services were later replaced by the minibuses known as matatus and a limited commuter rail service. According to Klopp, Garber and Quarshie (2019:18), the matatu industry is dominating the public transport system in Nairobi and makes its own rules with regard to route planning and coordination . Based on this, it can be concluded that there is limited regulation of the matatu industry in Nairobi.

Nairobi is one of the highly congested cities in Africa and, over the past few years, this urban transport challenge has put pressure on government to address this matter by making improvements to the public transport system. Klopp, Harber and Quasrhie (2019:18) alluded to "the political economy dynamics of decision-making and overall governance around urban transport in Kenya", which has slowed down progress regarding public transport reforms in this city. According to Klopp, Garber and Quarshie (2019:18), transport governance in Nairobi can be summed up by "five inter-related characteristics", which are fragmentation of government institutions on issues related to decision-making, reliance on foreign loans instead of public funds to implement transport infrastructure projects, a lack of information sharing and

transparency between government and members of the public, reliance on the private sector for public transport operations, and large physical infrastructure bias related to only favouring the implementation of big projects instead of also focusing on much-needed public transport projects that would benefit Nairobi citizens by reducing congestion. In the case of reliance on the private sector for public transport operations, another drawback is the fact that some public officials who perform traffic management functions are also operators of the matatus, thereby leading to conflict of interest, as mentioned by Klopp, Garber and Quarshie (2019:20).

The above-mentioned improvements called on government to introduce mass transit across Nairobi. As a result, a draft legislation on Nairobi Metropolitan Area Transport Authority (NaMATA) was developed and the NaMATA Bill was published in the Kenya Government *Gazette* in 2017, but was never enacted. In the absence of following all due parliamentary processes, an Executive Order was published to establish NaMATA (Klopp, Garber and Quarshie, 2019:21). This decision was followed up by discontentment among members of the public, including civil society at large as alluded by Klopp, Garber and Quarshie (2019:21).

The mandate of NaMATA (2024, n.d.) is to oversee "the establishment of an integrated, efficient, effective and sustainable public transport system within the Nairobi Metropolitan Area (NMA)". As a result of this mandate, NaMATA identified the following projects for implementation, namely Mass Rapid Transit in the form of Commuter Rail and BRT, as well as Non-Motorised Transport (NMT).

The BRT project comprises of five BRT corridors that were gazetted in 2019 by the NMA (NaMATA, n.d.). The first BRT line to be implemented is known as BRT Line 2 Pilot – Simba, which is 27 km in length and "runs along Thika Superhighway from Ruiru to Kenyatta National Hospital through Nairobi CBD" and it is being implemented by NaMATA (NaMATA, n.d.). It is reported that this project started in 2020 and was due for completion in 2022. However, delays have been experienced in this project owing to the redesigning of certain works, as well as budgetary constraints (Business Daily Africa, 2024). The contractors have since returned to work and it was envisaged that the Sh5.6 billion project would be completed in March 2025 (The Star, 2024).

## 2.4 European, Asian and American cities

The following sections will focus on research that has been conducted in cities where transport system investments have been used as a catalyst for effective integrated land use-transport development. Firstly, a matrix of seven cities: Stockholm (Sweden, Europe) and Copenhagen (Denmark, Europe); Hong Kong (China, Asia), Singapore (Singapore, Asia) and Seoul (South Korea, Asia); Portland (United States, North America) and Curitiba (Brazil, South America) that have been cited by different authors as cities that have invested in transport systems investments and land use development will be introduced in Table 2.1.

Table 2.1 will be followed by a map of the world, which shows where these cities are located according to country and continent (Figure 2.1).

## Table 2.1: Matrix of successful cases

| City, country, continent | Size/ shape/ population density | Type of transport improvement project | Planning and institutional arrangements | Project funding | Land value capture (LVC) and Transit-Oriented Development (TOD) | Land use patterns and development |
|---|---|---|---|---|---|---|
| Stockholm, Sweden, Europe | Star-shaped, radial rail lines | Metro rail: Tunnelbana | Stockholm City Council is responsible for land use and transport management | Stockholm City Council | TOD in new towns | Mixed land use for office, industry, residential<br><br>Tax incentives attracting industries to new towns |
| Copenhagen Denmark, Europe | Finger plan development of the city | Metro rail: Copenhagen Metro | Finger Plan of 1940s<br><br>Central government responsible for transport planning after abolition of the Great Copenhagen Council<br><br>Major developments established including Ørestad New Town, Metro and Development Corporation | Public loans with liability from municipality and the state<br><br>Revenue generated from land sales financed future phases of Copenhagen Metro | LVC used to fund future phases of Copenhagen Metro<br><br>Residential and commercial properties built within 50m from Metro stations<br><br>TOD with linear development pattern<br><br>Development of towns connecting to 5 rail transit corridors<br><br>Development of new towns with TOD accessibility leading to relocation of companies and educational institutions to Ørestad | Mixed land use development in new towns such as Ørestad<br><br>Development allocated to offices (60%), houses (20%), and facilities (20%)<br><br>Development restrictions along green areas by Finger Plan<br><br>Metro construction attracting land use development |
| Hong Kong, Special Administrative Region of the People's Republic of China, Asia | Mountainous, compact city with high-rise buildings, -highly dense | Mass Transit Rail | Proposal of Mass Transit Rail by Hong Kong Mass Transport Study<br><br>Planning Department responsible for urban planning<br><br>Steering Committee oversaw 1st implementation of the MTR<br><br>The MTR Corporation established to build rail infrastructure and operate services | Government major sponsor<br><br>Profits made from sale of development rights funding future phases of the project | Rail & Property Model: property development with profits used for rail infrastructure construction and operational<br><br>TOD in various towns across the city<br><br>TOD stations with high-rise shopping and residential buildings close to the station (mixed-used developments) | Promotion of mixed-used developments with car parking through R & P model |

| City, country, continent | Size/ shape/ population density | Type of transport improvement project | Planning and institutional arrangements | Project funding | Land value capture (LVC) and Transit-Oriented Development (TOD) | Land use patterns and development |
|---|---|---|---|---|---|---|
| Singapore, Singapore, Asia | Belt-shape urban form | Mass Rail transit: MRT | Concept Plan of 1971 followed by revised Plans Urban<br><br>Redevelopment Authority (URA) responsible for land use and transport planning | Government funded | TOD developed through practice<br><br>New towns developed as mini-downtowns outside Singapore | Integration of commercial and public facilities in TOD station areas<br><br>Decentralisation from 1960s to 2005s due to construction of new towns outside Singapore to attract land use development<br><br>New towns including schools, shopping centres and parks<br><br>Development of low-price housing |
| Seoul South Korea, Asia | 605km2 compact and highly dense city | BRT | Minimal role played by government till 2000s<br><br>Seoul Metropolitan Government implementing BRT<br><br>Mayor's office, technical officials, SDI leading Bus Reforms<br><br>BSRCC made up of all stakeholders for sharing of information and decision-making | Seoul Metropolitan Government funding the BRT and operating subsidies for bus operators | Increase in land value closer to BRT stations<br><br>Support of TOD by mayor with implementation of various projects in 2004 after public transport reforms<br><br>Building of high-density developments around Seoul | High-rise buildings due to limited space and high density<br><br>Satellite towns built to deal with housing problems in the city<br><br>Land use development and various policies encouraging built up of satellite towns<br><br>Access to affordable housing through inclusionary zoning policy<br><br>Levying of development fee to developers to discourage land use development |
| Portland USA, North America | | Light Rail transit: MAX | Development of the Portland Downtown Plan of 1972 to address land use and transport issues, with various revisions over the years<br><br>Political commitment and participation | Use of withdrawal funds for funding projects | TOD elements notable: mixed-use developments, 60% of ground space in building as retail space, limitations on commuter parking | Challenges with integration of transport projects with land use plans |

| City, country, continent | Size/ shape/ population density | Type of transport improvement project | Planning and institutional arrangements | Project funding | Land value capture (LVC) and Transit-Oriented Development (TOD) | Land use patterns and development |
|---|---|---|---|---|---|---|
| | | | from different levels of government with the support of technical officials<br><br>Central City Transportation Plan (CCTMP) of 1995 | | | |
| Curitiba Brazil, South America | Changed from circular pattern to quadrangular pattern | BRT | Agache Plan of early 1960s<br><br>Master Plan of 1966<br><br>IPPUC responsible for project implementation and coordination of a comprehensive development plan<br><br>Political involvement at municipal level influencing project implementation<br><br>High costs of LRT implementation favoured BRT implementation | BRT Phase 1 funded by government<br><br>Future phases funded through multiple funding streams including banks | Growth along linear axes with high population density and mass public transport along the axis<br><br>Medium and large developments built along transit corridors | Increase land value along the corridors<br><br>Revenue generated used to fund BRT projects, e.g. Green Line<br><br>Growth limitation towards city centre<br><br>Retail growth along transit corridors<br><br>Land use patterns: settlement shape, densities of development and location of services<br><br>Land zoning for high-density housing<br><br>Limited parking space in city centre linear development encouraged along the transit corridors |

**Figure 2.1: Map of the world**

Source: Ngcobo, 2024

A detailed discussion on the following cities, Stockholm, Singapore, and Portland, is found below. These three cities were chosen for further discussion because they are cities from different continents with different political and socio-economic backgrounds and are likely to exhibit different experiences in terms of the implementation of their respective public transport network improvement projects.

### European city: Stockholm

Stockholm, the capital city of Sweden, has a star-shaped built form (Cervero, 1995:41). This urban form is due to regional planning in past years, which sought to maintain the overspill and established rail-served towns around Stockholm (Cervero, 1995:41). It is reported that half of the population lives in the capital city and the other half of the population lives in satellite towns that are built around Stockholm. These towns are radially linked by the regional rail system known as the Tunnelbana (Cervero, 1995:41).

The city council of Stockholm has played a pivotal role in land use and transport development of this city. As explained by Cervero (1995:43), this dates back to 1904, when the city council started buying land for future developments, which has been witnessed over many decades. This has included multistorey apartments built on the outskirts of Stockholm after the Second World War, with about 90% of units built after 1946 benefiting from state subsidy (Cervero, 1995:43). It is reported that dense satellite towns have been built close to the rail station. As a result of this, residents can just walk to the rail station, thus reducing the need to use a car for travelling.

Furthermore, industries and offices in satellite towns have been distributed proportionally to the residential population. As a result of this, residents do not need to travel out of town for work purposes. This has been made by introducing tax incentives to attract industries to new towns, coupled with the provision of company housing. Land use management by the municipality has also ensured that shops, civic buildings and offices form part of the town planning in these new towns (Cervero, 1995:43).

Consequently, Stockholm is one of the cities in Europe that has reduced car dependency, especially during weekdays when residents use public transport to travel to and from work, with private vehicles being used for personal trips. For example, peak hour travelling in Stockholm is as follows: 55% in one direction by train and 45% in another direction (Suzuki, Cervero & Luchi, 2013:56). Stockholm recorded a reduction in car usage between 1980 and 1990 (Suzuki, Cervero & Luchi, 2013:57). This city has been at the forefront of supporting TOD and the residents are at ease with the daily use of public transport.

Paulsson (2020:2939) reports that "Stockholm is a unique case in the TOD literature since it displays integration between rail-bound public transport and settlement patterns". Furthermore, Paulsson (2020:2939) acknowledges that this kind of integration would not have been successful without the support from politicians from the City of Stockholm, who ensured that future housing development took place. The above events from Stockholm show the important role played by different stakeholders, in this case politicians, with regard to planning and institutional arrangements before project implementation.

In 2013, negotiations led to the extension of the blue line in Stockholm with the negotiations of this project known as the Stockholm Negotiation. In this case, rail or metro system expansion was done in parallel to housing developments. The following are two examples that show how Stockholm has approached TOD in the newly developed towns.

Vallingby is one of the satellite towns that was established between 1950 and 1954 (Cervero, 1995:43). With regard to TOD in Stockholm, Suzuki, Cervero and Luchi (2013:57) describe Vallingby as one of the new towns which has adopted TOD and has developed as follows:

> The rail stop sits squarely at the town centre. Upon exiting the station, passengers step into a car-free public square surrounded by shops, restaurants, schools, and community facilities. The civic square, adorned with benches, water fountains, and greenery, is the community's central gathering spot—a place to relax, socialize, and hold special events, such as public celebrations, parades, and demonstrations.

This town has captured the elements or characteristics of TOD, where social and economic facilities are situated close to the rail station and within close proximity to one another, allowing people to walk and access different amenities within the town centre.

According to Suzuki, Cervero and Luchi (2013:58), Hammarby Sjöstad is Stockholm's largest urban regeneration project to date, with "160 hectares of brownfield

redevelopment", which has a transit line in the form of a tramway. Also, Hammarby Sjöstad town has a cluster of tall buildings situated along the tram spine with an efficient tram system that runs every seven minutes during peak hours and "provide five-minute connections to Stockholm's metro underground network and commuter trains" (Suzuki, Cervero & Luchi, 2013:58). This town also has an efficient, safe and easily accessible railway and bus systems. Suzuki, Cervero and Luchi (2013:58) provide a well-detailed description of strongly visible TOD features in this town, such as parks, bike lanes and bike parking, preserved landscapes where possible, safe walking corridors and pedestrian bridges across waterways.

Hammarby Sjöstad also possesses characteristics of green urbanism due to energy building, water and waste management, and energy production (Suzuki, Cervero & Iuchi, 2013:58). As a result of this, Suzuki, Cervero and Luchi (2013:58) reveal that this town has taken extra conservation measures such as low-flush toilets, individual heating mechanisms for apartments, solar panels and light control, including buildings that are well-insulated with triple glazed windows. This has resulted in Hammarby Sjöstad being referred to as the green TOD (Suzuki, Cervero & Luchi, 2013:59).

**Asian city: Singapore**

Singapore is a city-state and an island that used to be part of Malaysia until political-economic tensions forced it to become an independent and sovereign state on 9 August 1965. This Asian city is currently a member of the Commonwealth (countries that used to be under the British Empire before independence).

Singapore is one of the Asian cities that have experienced the urban problem of traffic congestion due to increased car ownership. To alleviate this problem, Sim, Malone-Lee and Chin (2001:401) explain that:

> Like many other cities, Singapore faced the dilemma of heavy reliance on private car usage, but the government placed high priority on tackling traffic congestion problems through reconnecting land use and transport by integrating urban development with a high quality MRT system (Newman & Kenworthy, 1996). At the same time, it introduced tough but effective demand management measures to reduce reliance on car usage.

From the above, one can clearly see the government's commitment to solving traffic congestion in this city.

Singapore tackled the issue of increasing car ownership in a unique way by introducing Electronic road pricing, Vehicle Quota System (VQS), and Car-sharing Co-operative (Sim, Malone-Lee & Chin, 2001:401). The Singapore government did not have a problem with people buying cars if they adhered to the above control mechanisms (Han, 2010:317). It should be noted that for some people, buying a car is a status symbol, which also comes hand in hand with affordability. Besides the above policies that facilitate controlled motorisation, the Singapore government is, on the other hand, also promoting the use of public transport systems. This has been done through policies that address issues regarding the use of buses, taxis, MRT, and Light Rail Transit (LRT), as well as addressing diverse demands in Singapore. The Singapore government has tried to accommodate both car and public transport users by

introducing various policies to “control car ownership and usage”, as reported by Han (2010:318).

The work of Han (2010:320) has also shown that Singapore is one of the Asian countries that promotes car ownership as part of economic growth and development. Simultaneously, it also promotes the use of public transit, unlike in developed countries such as Australia and USA, where the move is predominantly towards public transit in some cities.

Land use and transport planning in Singapore goes back to 1958 and has been revised over the years. The first Concept Plan was a building block for the entire spatial structure of Singapore and was proposed by the Urban Redevelopment Authority (URA) in 1971 (Niu et al., 2019:17). As a result of this plan, “a belt-shaped urban form with downtown and natural reserves in the centre” was realised. Low-cost housing was part of this Concept Plan with the Housing and Development Board (HDB) developing “low-price housing to guide and improve living conditions and improve living environment of the city” (Niu et al., 2019:18). This had to be done to ensure that all citizens benefited from the implementation of this Plan. New towns were built, including schools, shopping centres and parks.

Then, the revised Concept Plan of 1972 saw the implementation of the MRT in 1982 to link new towns with major employment centres in the CBD and Jurong (Sim, Malone-Lee & Chin, 2001:401). According to Sim, Malone-Lee and Chin (2001:401), the revised Concept Plan in 1991 came up with the proposal of four regional centres, which were Tampines in the East, Seletar in the North-East, Woodlands in the North and Jurong-East in the West as mini-downtowns. The aim of these towns was “to provide a range of commercial, retail, hotel, entertainment and other facilities to attract workers to work in these centres” (Sim, Malone-Lee & Chin, 2001:401).

Another point to take note of is that in Singapore, TOD was forced to develop through practice whereas in the United States of America (USA) TOD developed from theory to practice (Niu et al., 2019:19). This may be because Singapore, as a developing country, had to address high-density challenges while developing the city with limited resources, and it did not have the luxury of testing the theories or practices of TOD, unlike the US, which has been a developed country for many decades (Niu et al., 2019:19). Singapore has also been hard at work regarding land use and transport integration by ensuring that the rapid rail system is available across the city and surrounding towns.

The study looked at the “land use characteristics and development pattern of TOD station area in new towns of Singapore at the meso level” (Niu et al., 2019:19). This was achieved by answering two questions related to “differences between TOD station sites and non-TOD station sites in terms of land use characteristics; and interpretation of the land use characteristics of the TOD station sites located in different new towns” (Niu et al., 2019:19).

One of the findings of this study of differences between TOD and non-TOD station sites was that integration of commercial and public facilities was found in the rail transit

station with the TOD station area, and there was no integration of facilities in the non-TOD station site in the private estate (Niu et al., 2019:20). Another finding which is related to the interpretation of the land use characteristics of the TOD station sites located in different new towns was that when comparing to neighbourhood TOD station areas, the "urban TOD station areas have higher proportion of commercial land, lower proportion of residential land, and higher land use mix degree because these land use characteristics reflect different positions of the station site in the hierarchy of urban public centres" (Niu et al., 2019:24).

It should be noted that Singapore realised decentralisation during the past five decades, from the 1960s to 2005. This was due to the construction of new public housing developments outside Singapore in the five new towns, which went hand in hand with the expansion of the mass transit lines, as illustrated by Yang and Lew (2009:95). In other words, the above strategy can be seen as one of the measures adopted by Singapore to attract land use developments to desired locations.

**American city: Portland**

Portland is one of the American cities that was slowly dying in the 1970s but survived by integrating land use and transport systems (Arrington, 1996:1). The city experienced a decline in housing units in Downtown Portland from 28000 units in 1950 to 11000 units by 1972 even though the metropolitan population was showing signs of growth (TriMet, 2010:22). Furthermore, demolition of historical buildings took place so that the vacated land could be used for car parking (TriMet, 2010:22).

Then, the city produced a plan known as the Portland Downtown Plan in 1972, which proposed comprehensive policies and strategies to reverse the above situation (TriMet, 2010:22). Thereafter, the city mayor established a committee to implement the Plan, and this committee consisted of city officials and consultants (TriMet, 2010:22). The Plan "addressed various land use and transportation issues, came up with a proposal for major new public investments and identification of 21 'imagable' districts within downtown" (TriMet, 2010:22). One of the proposals from this Plan was the development of incentives, namely subsidies, tax incentives or increases in density to boost rehabilitation or construction of houses in Downtown Portland (TriMet, 2010:23).

The above interventions showed political commitment and will to change the status quo. It is encouraging to note that the Plan was implemented by the city from 1974 and led to various projects that were more aligned to prioritisation of people's well-being and land use developments (TriMet, 2010:23). This was done by establishing the bus mall and implementing pavement treatments, lighting and putting together street furniture, retail and office developments.

Then, in 1988, Portland adopted the Central City Plan as part of the City's Comprehensive Plan, and this resulted in extensive zone changes in the plan area (TriMet, 2010:23). Moreover, the Central City Plan's aim was to implement bigger projects than the ones implemented in the Portland Downtown Plan.

Arrington (1996:2) noted that the success of projects implemented in Downtown Portland was due to “collaboration between strategies and among governments” and highlighted the following strategies that were adopted by the city to ensure this success:

- The Central City Plan focuses more on the development adjacent to transit.
- Development occurs at a pedestrian scale with a mix of uses and no permission for blank walls. Also, buildings are required to be up to the street, and 60% of the ground floor is dedicated to retail space.
- There are strict limitations on the amount of commuter parking, with downtown office buildings having “tight parking maximums, but no minimums”.
- Less parking allowance for retailers or businesses closer to MAX (the light rail transit operating in Portland).
- TriMet “has expanded service by 140% and has seen more than a 220% increase in ridership” since 1971.
- Improvement in transit investments has helped Downtown Portland benefit from investments in the Portland Transit Mall, Fareless Square and MAX.
- There has been “no addition of new road capacity in downtown for 20 years” due to “a balanced transportation strategy”.
- There is an Urban Growth Boundary (UGB), which defines parts that are rural and those that are urban areas. The change in 235,000 acres growth boundary has been less than 3% since its adoption in 1979, and this has led to the increase in population growth within the UGB by more than a third.

The above measures that were put in place have resulted in a vibrant downtown with MAX and Transit Mall for use characterised by an increase in the number of jobs, improved air quality within the city, reduced congestion, 40% of work trips travelled by transit, and transit becoming the mode of choice in Downtown Portland (Arrington,1996:3).

It should be noted that the alternative to building more highways, which would not have been approved, was to implement the transit system in the CBD to revitalise the CBD, as explained by Edner, Adler and Morris (1989:3). Portland was, at the time, faced with funding the MAX and maintaining the existing freeways. Edner, Adler and Morris (1989:3) state that this was done using withdrawal funds. According to Edner, Adler and Morris (1989:3), there was a need for regional consensus to enable the Portland representatives to get state commitment and for the “Oregon representatives in Congress to secure funds at federal level”. Without the above commitment, it would have been difficult for Portland to implement the above projects. This highlighted the importance of agreement at regional level. In other words, the city needed the buy-in from the higher level of government before any project implementation. Edner, Adler and Morris (1989:15) provided a well captured background of work done by various politicians in their different capacities in Portland to ensure that transport planning processes were streamlined and funding for transport projects was recommended and approved. The collaboration of these politicians was crucial for the success of the above transport projects as funding proved to be a challenge.

Then came the Central City Transportation Plan (CCTMP) in 1995, which was guided by three central concepts i.e.: assurance of liveability with growth, assurance of mobility with growth, and assurance of liveable streets with growth, as noted by TriMet

(2010:23). Furthermore, the CCTMP was leaning more towards encouraging citizens of Portland to use other modes of transport besides cars and ensuring that housing developments in the central city encouraged people to walk, bike and use transit as part of liveability and growth (TriMet, 2010:24).

Besides a funding challenge, as highlighted above, Portland has also experienced a challenge with integrating transport projects with comprehensive land use plans (Edner, Adler & Morris, 1989:16). Ensuring that both transport projects and environmental land use plans are implemented has not been easy for Portland. Edner, Adler and Morris (1989:16) state that:

> While Portland's new transport regime began to emerge shortly after the adoption of the State's land use planning law, the interface between environmental and transport planning perspectives was not an easy one.

There have been different views on land use and transport planning in Portland.

## 2.5 Chapter conclusion

As indicated above, the purpose of this chapter was to review work that has been done in developed and developing countries on BRT and rail transit systems implementation to assist with the selection of case studies for more detailed work in later chapters. With regard to South African cities, there is limited research published after BRT implementation in the cities of Johannesburg and Cape Town. However, the cities of Johannesburg and Cape Town are slowly working towards a TOD approach while implementing different phases of their BRT systems. For a country such as South Africa, which was spatially dispersed due to apartheid, the TOD approach will be different from one city to another city and will also take time to implement. The Gautrain stations have somehow addressed the TOD approach and shown that some elements of land value creation can be achieved.

A review of BRT case studies in two African cities; namely Lagos and Nairobi was also provided. The Lagos BRT Lite has been fully operational since 2008. The Bus Reform Initiative in Lagos took place between 2017 and 2019, and was aimed at improving capacity and customer experience. It was envisaged that the first BRT line in Nairobi would be completed by March 2025.

A matrix of cases in seven cities followed by summaries of public transport network developments in three cities in Europe, Asia and America formed part of this chapter. The three cities (Stockholm, Singapore and Portland) showed that research has been conducted on transit systems in them before and after the implementation of these systems.

In Europe, Stockholm has seen its public transport improvements including the rail system, through the full support of its politicians, who have been at the forefront of leading and supporting these developments, including TOD. Land use and land value capturing have been part of the development of the city over the years.

Singapore has been experiencing traffic congestion problems for years due to increased car ownership. The government implemented road user charges and VQS to address this urban transport problem while supporting the use of public transport, such as the MRT and Light Rail. Land use and transport planning integration have been experienced in Singapore since the late 1950s. Also, new towns have been developed away from the CBD, and they provide various retail, commercial, and hotel facilities. There is also a strong presence of TOD in Singapore with TOD stations found in all new towns around Singapore.

Portland experienced challenges in the 1970s with regard to growth in downtown and was later assisted by the introduction of plans to attend to the growth and development of the downtown area. The immense support from the government, especially politicians, has enabled Portland to implement various transport and land use planning projects over the years, even though the integration was not easy to achieve and funding for projects was limited.

The discussion above made it clear that the three cities have faced challenges with the implementation of their transit systems but have managed to survive despite these challenges. There have been reports of the positive impact, such as changes in land use patterns next to where stations are located. An observation was made that for the three cities to have a successful integrated land use transport development, they needed to implement a public transport network improvement project, which would act as a catalyst for this kind of development.

# 3. RESEARCH METHODOLOGY

## 3.1 Introduction

This chapter provides a research methodology, or the method used to conduct this research study. The first section of this chapter defines qualitative research in detail. The second section focuses on the case study selection, which clearly outlines why certain cities were selected to be part of the case studies. The third section details the research design, which mainly discusses the processes undertaken during the research, including the methods and techniques for data collection and analysis. The last section provides a summary and concluding remarks on this chapter.

## 3.2 Qualitative research

Qualitative research is mainly used to understand a research subject by getting detailed information on the subject using research questions where data is collected using various data collection methods followed by an analysis of the information gathered.

As stated by Agius (2013:204), qualitative research refers to research that is conducted through various methods, such as making observations, in-depth interviews, focus groups, consensus groups, case studies and text interpretation. This type of research is different from quantitative research, which is quantifiable and measurable. Furthermore, social science fields tend to use this kind of approach (qualitative research) in their research studies.

Tomaszewski, Zarestky and Gonzalez (2020:2) provided detailed and in-depth research on the design criteria of the four commonly used qualitative research approaches and how they link to specific data collection and analysis. The four research approaches referred to in their research study are case study, ethnography, narrative and phenomenology.

According to Tomaszewski, Zarestky and Gonzalez (2020:2), the goals of these four qualitative research approaches are as follows:

- Case study: To describe a case(s) to develop an in-depth understanding of the context of a specific case(s).
- Ethnography: To describe shared and learnt cultural practices of a specific group of people.
- Narrative: To describe stories told by people about themselves through experiences and/or their lives.
- Phenomenology: To describe the meaning of the lived experiences of a person(s).

## 3.3 Case study selection

Kumar, Zimmerman and Agarwal (2012:2) discussed case studies on BRT in the following cities: Johannesburg (South Africa), Lagos (Nigeria), Jakarta (Indonesia), Ahmedabad (India) and Delhi (India). This was done by exploring the following issues:

Geographic, Economic, Demographic, and Transport contexts of the project; Political, Governance, and Planning Background; Communications; System Concept, Integration, and Performance; Operating Arrangements; and Financial arrangements of the project in order to identify lessons learnt from the BRT projects implemented in these five cities (Kumar, Zimmerman & Agarwal, 2012:6).

Chapter 2 provided a matrix of cities that implemented public transport network improvement projects in their respective cities. To align with the case studies by Kumar, Zimmerman and Agarwal (2012:2), this research study takes the Political, Governance and Planning (planning and Institutional, Operating and financial arrangements (nature of the investment)) elements of the study and include them in the research questions as highlighted in Chapter 1. It will also discuss the impact of the implementation of the systems in terms of Land value capture, Transit-Oriented Development, Land use patterns, and travel behaviour.

The following criteria were used to select cities where case study research would be conducted:

- Cities that represented integrated land use development.
- Cities from different continents: Europe, Asia, America.
- Cities from countries with different economies (developed and developing countries).
- Cities where detailed research and information on various questions as outlined in the research questions (Chapter 1) could be collected.

The rationale for selecting Copenhagen, Curitiba, Hong Kong and Seoul, which were chosen as cases for this research study out of the seven cities that were summarised in Chapter 2, was based on the above-mentioned criteria. The leading factor was that these cities seemed to have more research work conducted on various research questions.

## 3.4 Research design of the research study

This section discusses the processes undertaken during the research, including the methods and techniques for data collection and analysis. As mentioned above, the case study research approach was used in this research since the aim of this study was to gain an understanding of changes that have been made by the implementation of the BRT and rail transit systems on urban form, land use patterns and development, including the lessons learnt from these projects. In other words, the goal of this research was to develop an in-depth understanding of the implementation of various public transport network improvement projects.

Priya (2021:95) points out the following attributes of a case study: a research strategy and detailed research, which allows the researcher to use different methods of data collection as long as these methods are suitable for the concerned research, such as interviews, surveys, observations and document study (e.g. books, archived manuscripts).

It is also important to note that there are different types of case studies a researcher can choose from depending on the purpose of the research study, as mentioned by Priya (2021:99). These types of case studies are briefly discussed below.

The WAC Clearinghouse (n.d.) identified four types of case studies:

- Illustrative Case Study: This case study is used to describe “what a situation is like” by using “one or two instances of an event”, and this enables the study “to make what is unfamiliar familiar**”** (WAC Clearinghouse, n.d.).
- Exploratory Case Study: This case study is conducted at an early stage before a large-scale investigation is undertaken. An exploratory case study helps the researcher to understand the topic being investigated and identify how the big investigation can be conducted, for example, by identifying suitable questions.
- Cumulative Case Study: In this case study, information collected at different times is combined and affords the researcher the opportunity to make “generalisation without additional cost or time” being spent on collecting new information.
- Critical Instance Case Study: This case study attempts to investigate one or more phenomena to avoid generalisation and focus on something that could be of interest.

Yin (2018: Illustrative Structures for the Substance of Your Case Study) also defined three case studies: Explanatory, Descriptive, and Exploratory. Two of these case studies, Exploratory and Descriptive (Illustrative) are the same type of case studies that were also discussed in the WAC Clearinghouse. Yin (2018: Chapter 2: Design) goes on to discuss instances where a researcher must choose between using a single case study or multiple case studies in a research study. Yin (2018: Chapter 2: Design) explains that a single case study is used when only one case is being researched and asserts that the single case study “can be invaluable if it has any of the following characteristics: being critical, extreme or unusual, common, revelatory, or longitudinal case”. On the other hand, a multiple case study involves two or more cases that are researched at the same time. According to Yin (2018: Chapter 2: Design), multiple case studies provide stronger insights than single case studies.

Considering this, the researcher selected cumulative and multiple case studies since information had to be collected from different sources at different times, and cases from four cities had to be researched to get stronger insights from the research questions.

The research questions were prepared as per Table 3.1, as summarised by Tomaszewski, Zarestky and Gonzalez (2020:2), and were guided by the literature review.

**Table 3.1: Design criteria for a case study**

| Criteria | Description |
|---|---|
| Goal | To develop an in-depth understanding of a specific case |
| Research questions formulation | What are the qualities or characteristics of the unique or representative case? |
| Sampling | Context of the case |
| Data collection | One method or combination of the following methods can be used: Focus groups and/or one-on-one interviews where the case is discussed, making observations for a particular period regarding a particular case, making observations of the setting where the case(s) occur, accessing electronic and hard copies of documents that are representatives of the case |
| Data analysis | Constant comparative<br>Themes |

Source: Tomaszewski, Zarestky and Gonzalez (2020:2)

Table 3.1 gives an understanding of the approach of this research study, which takes the form of a cumulative and multiple case study.

It is worth taking into account that at the end of the research the researcher was expected to identify the lessons from these case studies to assist on how South African cities should approach the implementation of the BRT and rapid rail systems projects. If two cities (one for BRT and one for rail transit) had been used, it would have limited the researcher to identifying lessons from only one case, especially considering that the research had to be for both BRT and rail transit system projects. This ties in with Yin (2018: Chapter 2: Design), who recommended that a multiple case study is stronger than a single case study as mentioned above. It was also important to select these cities since they possessed characteristics for the questions being considered, as explained by Agius (2013:205), who insisted on sampling in a systematic way in qualitative research based on the relevance of the cases. It is against this context that information was collected on Copenhagen, Curitiba, Hong Kong and Seoul.

Information was searched using multiple search words as per the research questions. The researcher included keywords that were found in different questions to ensure that information gathered would address all research questions. Since the research questions entailed gathering information and data before and after project implementation, the researcher relied on getting information from various online documents, namely journal articles from the UCT online library and internet sites; academic research reports and papers from the internet; and information from organisational websites in line with the case study, including published Annual Reports, internet information and online newspaper articles. During the literature review and identification of lessons learned from the four case studies, governmental documents such as annual reports, annual performance plans and media statements were used to source information. This was mostly done when sourcing information from South Africa. Governmental websites were also used to source information, for example, in Curitiba, the URBS website was used to collect information, as outlined in Chapter 5. Online newspaper articles from towns were mainly restricted to news when conducting the literature review in South Africa. This was in line with the data collection referred to in Table 3.1.

It should be noted that the researcher was unable to use other methods of data collection, such as one-on-one interviews, focus groups, or observations, to augment the above data collection since the case studies were on cities in European, Asian, and South American countries. One-on-one interviews could have shed more light on issues that were not fully addressed during data collection due to limited or lack of documented information.

After data collection, data analysis entailed creating a synthetic matrix, which is a tool for data analysis assisted in outlining similarities and differences found in the four case studies and then identification of the lessons from the project implemented. According to the University of Arizona Global Campus Writing Centre (UAGC Writing Centre, n.d.), to organise research and provide a visual presentation of main ideas or themes, a synthesis matrix can be used to integrate data from different sources, which in the end can help with analysing the information collected. Based on this, this research study also used a synthesis matrix as part of data analysis. Collected information from the four case studies was summarised and arranged into different themes. These themes were derived from the research questions. Thereafter, information from the above themes were used to identify similarities and differences between themes of the collected data. These similarities and differences enabled the researcher to determine lessons learnt from the four case studies and how these lessons can be applied in the South African context regarding bus rapid and rail transit system developments and implementation.

## 3.5 Chapter conclusion

This chapter was used to highlight and discuss important aspects of the research methodology that was used in this research study, including different types of case studies. It provided detailed information on how the data was collected and analysed to understand changes made because of the implementation of BRT and rail transit projects in the cities of Copenhagen, Curitiba, Hong Kong and Seoul. It also provided the criteria that were used to select the four case studies, which will be discussed in Chapters 4 to 7.

# 4. COPENHAGEN CASE STUDY

## 4.1 Introduction

This chapter discusses the Copenhagen Metro. Before discussing planning and institutional arrangements in Copenhagen and how the city's metro rail network project affected land use transport in the city, a brief background of the city is provided. Copenhagen is the capital city of Denmark. This city dates to the 900s and its development during the 1160s was through its close linkage to the church and later to the aristocracy through Danish kings in the 15th century, as reported by Andersen and Jorgensen (1995:14).

Andersen and Jorgensen (1995:14) explain that housing in Copenhagen has seen continuous developments over the years, with Copenhagen centre and suburban areas consisting of flats of five to six storeys and detached or semi-detached houses. Furthermore, Andersen and Jorgensen (1995:14) referred to the social structure of Copenhagen as being based on the general expansions from 1940 to 1980 and indicated that "the duality of the Danish housing market" has been characterised by private homes or social housing. It should be noted that both types of housing are mainly subsidised by the government (Andersen & Jorgensen,1995:14). This has resulted in Copenhagen being one of the first-world cities where the lines between social classes are not easily identified as the social welfare system has favoured all citizens, no matter which class they come from.

## 4.2. The planning and institutional arrangements for public transport before project implementation-Copenhagen Metro

Copenhagen is characterised by a Finger Plan, which is a report that proposed the development of Copenhagen from the city centre with towns (forming five fingers) in the 1940s. Furthermore, the Finger Plan is described "as a hand, with the palm covering the city while the fingers (radials) show the populated areas outside the city" (Vuk, 2005:224). This is supported by Book, Eskilsson and Khan (2010:386), who mention that urbanisation was formed through radial corridors in the city centre of Copenhagen. Moreover, the Finger Plan has resulted in different suburban areas.

With regard to planning, the Finger Plan proposed that the city becomes more of a cultural and administrative area with the towns developing along the radials, becoming residential areas, explains Vuk (2005:224). Considering this, retail, education and banking facilities would be established in these towns "with the regional train network, the city train network (S-train)," and roads forming part of the implementation of the plan (Vuk, 2005:224).

It should be noted that there have been revisions of the Finger Plan, which resulted in the Preliminary Outline Plan of the 1960s, the Structure Plan of 1972, the Regional Plan of 1989, and the 2003 Traffic Plan. A brief outline of these plans is found below:

- According to Andersen and Jorgensen (1995:17), the Preliminary Outline Plan called for the development of another new centre to the west to address increasing traffic congestion and air pollution in the city. However, this plan was

never completed since it did not gain support from politicians and planners in the city.

- Then the Structure Plan of 1972 sought to “address unlimited economic expansion” by producing four nodal centres at the point where the radials met the belt (Andersen & Jorgensen, 1995:17). Also, Vuk (2005:224) summarised the Plan as coming up with a proposal of having several ring road connections between the radials. It should be noted that the Structure Plan had assumed continuous suburban growth due to increased economic growth and increased car use, but the plan did not work well due to the economic crisis of the early 1970s and early 1980s in Denmark, which led to population stagnancy and decline in urban expansion (Andersen & Jorgensen (1995:17).

- According to Andersen and Jorgensen (1995:17), the Regional Plan of 1989 came up after the above-mentioned economic crises and resembled the Finger Plan with an emphasis on growth outside the city and improved transport system. According to Vuk (2005:224), this plan:

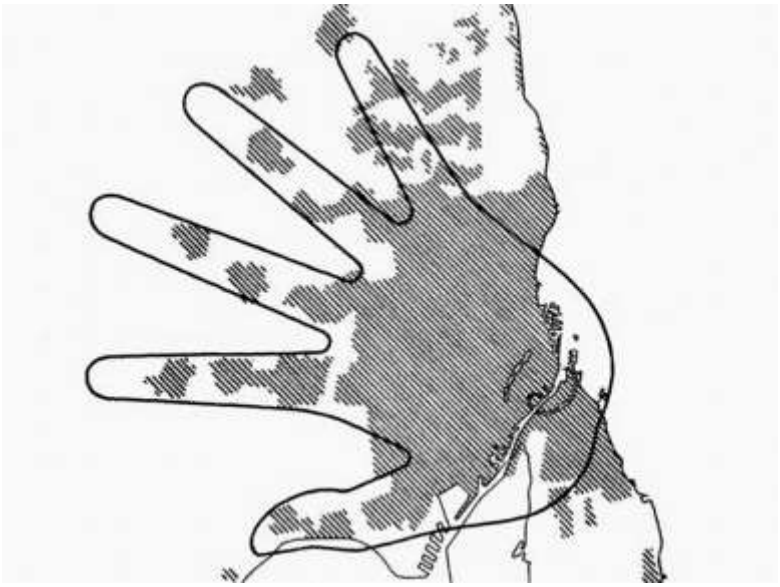
> …introduced “the proximity to station policy”, which permitted the building of industrial and service facilities in the cluster towns along the radials, where train stations are located within a 1-km radius. This eliminated some commuter traffic to the city centre.

Vuk (2005:224) refers to the proximity to station policy as the principle of location near a station.

- The Traffic Plan of 2003 was defined by a large hand, showing growth over the years, while the small hand still identified with the 1947 Finger Plan. According to Vuk (2005:224), “the 2003 Traffic Plan includes the 6th northbound finger alongside Sjælland east coast (towards Helsingør), which is serviced by high frequency regional trains”.

Figure 4.1 shows the Finger Plan of 1947.

**Figure 4.1: The Finger Plan of 1947**



Source: Sorensen and Torfing (2019: 226)

In Figure 4.1, the palm of the hand represents Copenhagen city with the administrative and cultural buildings located in the city. Then the five fingers represent the towns (radials), which have grown over the years in terms of length and width (Vuk, 2005:223). In between the fingers, there are green wedges or areas. According to Sorensen and Torfing (2019:222), no building or construction is allowed in those areas (green wedges). These areas have just developed into natural greenery areas over the years.

Based on the above plan, the transport system in Copenhagen and cluster towns had to change in support of the above plan.

**What were the planning and institutional frameworks?**

Planning in Copenhagen was under the Great Copenhagen Council from 1973, and its main responsibility was transport planning, including physical planning of hospitals and coordination; and there have been some disagreements in Copenhagen with regard to planning, as reported by Andersen and Jorgensen (1995:17). This Council, consisting of mayors, collapsed in 1989 due to its failure to resolve competition between municipalities on issues related to the future development of towns (Andersen & Jorgensen, 1995:19). The left-wing mayors did not want interference with their town plans and saw the Council as “the stumble block” to fulfilling their own political aspirations (Andersen & Jorgensen, 1995: 19).

After the abolition of the Great Copenhagen Council, the central government started playing a pivotal role towards directing planning in Copenhagen. The central government made proposals towards major developments in and around Copenhagen, such as building of the bridge or tunnel and improved transport projects, including new railways and urban development (Andersen & Jorgensen, 1995:19). Knowles (2012:254) names the following four projects that were approved:

- Redevelopment of Copenhagen Harbourfront.
- Ørestad New Town, Metro and Development Corporation.
- Øresund Fixed Road and Rail Link to Malmö and southern Sweden.
- Cultural Capital of Europe 1996.

With the above pronouncements made, Copenhagen officials were then expected to implement these projects in their respective departments.

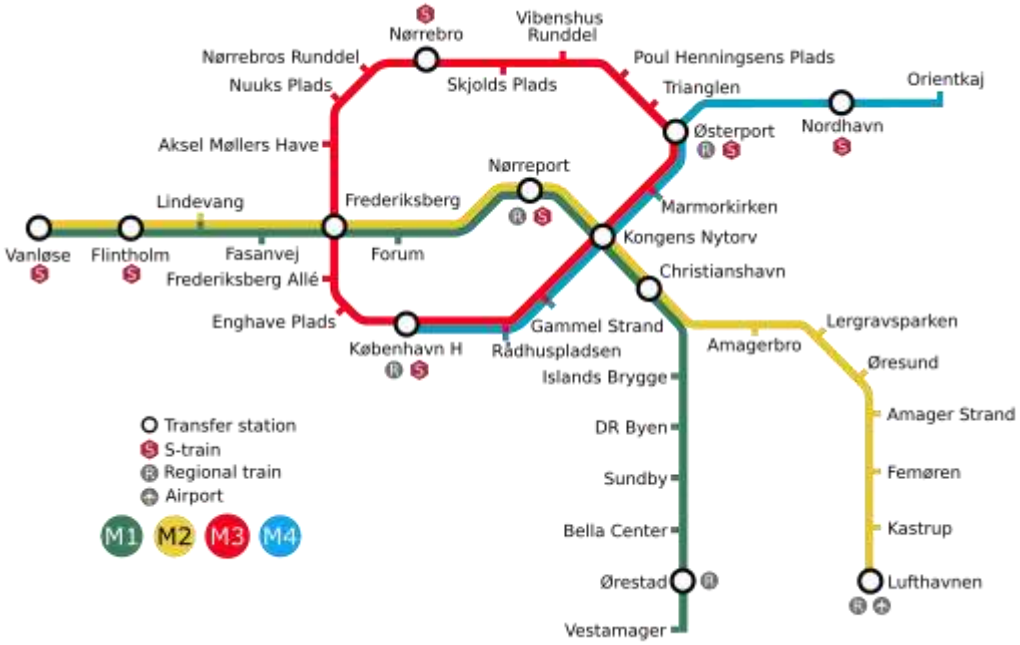
**How did these frameworks facilitate the implementation of the project?**

As far back as the early 1990s, there was a plan to introduce a new railway transit system known as the Copenhagen Metro. This was in line with the four proposed projects outlined above. Vuk (2005:224) also attests to the planning decisions that were made in the early 1990s to minimise travel time in and out of Copenhagen and that Copenhagen Metro was then seen as a measure to enlarge the public transport infrastructure to reduce travel time.

Construction works of this project started in 1994, with Phase 1 of the project starting its operations in 2004. Figure 4.2 shows the different Metro lines, from M1 to M4, which have developed over the years. Phase 1 was an 11 km route with two lines, Metro Line

1 (M1) and Metro Line 2 (M2). M1 connects to a new town, Ørestad, in the west, and M2 runs to Lergravsparken, explains Vuk (2005:225). Over the years, there have been additions of M3 and M4 Metro Lines.

**Figure 4.2: A map of the Copenhagen Metro with the City Circle Line**




Source: Arthur (2009) [15 July 2024] CC-BY-SA-3.0,2.5,2.0,1.0

## 4.3 The nature of the transport investment

The nature of the transport investment related to the Copenhagen metro will be discussed in three sections: project sponsor, structure of the investment, and loan payment arrangements (if they were made).

### Who was the project sponsor?

It should be noted that the Copenhagen Metro is a driverless, 24/7 light rail transit and was implemented because of an Act of Parliament that was passed by Denmark in 1992 to establish the Ørestad Development Corporation that would be responsible for planning and developing land next to the city centre of Copenhagen (Andersen & Jorgensen, 1995:20). The Ørestad Development Corporation was jointly owned by Copenhagen municipality and Danish state. The percentage ownership of the Ørestad Development Corporation was reported to be 55% and 45% for Copenhagen municipality and the Danish state, respectively (Book, Eskilson & Khan, 2010:387; Noring, 2019:126). Considering this, the Copenhagen Metro became part of the Ørestad development. As stated by Noring (2019:126), the national government was responsible for land allocation and the local government for rezoning the land for commercial and residential purposes. Figure 4.3 shows a photo of the Copenhagen Metro.

**Figure 4.3: Copenhagen Metro**

Source: Wickett (2006) [15 July 2024]

### How is the investment structured?

Funding for the construction of this project was made through public loans. There was no direct funding from the municipality or the state. It should be noted that Phase 1 construction costs were DKK 6.7 billion (approximately EUR 900 million) (Vuk, 2005:225). However, the municipality and the state were both liable for the payment of the loans since they both had shares in the Ørestad Development Corporation, which was initially responsible for the payment of the loan. Later, City & Port took this responsibility after Copenhagen decided to restructure Ørestad Development Corporation into City & Port in 2007 (Noring, 2019:126).

### Are there any loan payment arrangements?

According to Andersen and Jorgensen (1995:20), loan repayments would be made through the value added by selling land next to the developments that would have been constructed. Noring (2019:131) reports that City & Port takes out loans against the increased value of its re-zoned and repurposed land assets to fund the construction of the Copenhagen Metro. This means that monies collected from these sales are then used to pay loans.

Noring (2019:128) provided detailed information with regard to public and private financing of infrastructure projects, but no detailed information was provided on loan payment arrangements for the Copenhagen Metro project besides the information provided above.

## 4.4 The operational arrangements of the system

The operational arrangements of Copenhagen Metro are discussed below.

### Who is the operator of the system?

According to Metro Service A/S (n.d.) Copenhagen Metro is operated by Metro Service A/S, a privately owned company, which is a joint venture between the companies Azienda Transport Milanese (ATM) and Hitachi Rail STS. ATM is known for providing public transport in Milan and 46 other towns in Lombardy, Northern Italy (Metro Service A/S (n.d.). On the other hand, Hitachi Rail STS (former Ansaldo STS) was also involved in the development of Copenhagen Metro and falls under the Hitachi group. Furthermore, the Hitachi group is known for providing high-tech solutions for railways, control, and signalling systems used for public transport in large cities (Metro Service A/S (n.d.). Based on the experiences of these two companies outside and within Copenhagen Metro and the types of services they have provided to various cities, Metro Service A/S sees itself as being the best company to provide operational services to Copenhagen Metro (Metro Service A/S, n.d.).

### What are the roles and responsibilities of the operator?

Metro Service A/S is responsible for the operations and maintenance of the Copenhagen Metro (Metro Service A/S, n.d.).

The roles and responsibilities under operations consist of the following aspects:

- Provision of stable and good service: This is important since the metro operates 24/7. The emphasis is put on customer satisfaction of passengers that use the metro on weekdays. It is reported that on average the Copenhagen Metro has 13,000 daily departures (Metro Service A/S, n.d.).
- Taking fast and correct decisions: This is important in the operations of the metro for the benefit of the operations. Because of many years of experience by this company in the operations field, it is able to solve problems in a quick and efficient manner taking into consideration that the Copenhagen Metro operates on a 24-hour basis, and any operating disruptions have to be fixed immediately to avoid or minimise negative impact on passengers (Metro Service A/S, n.d.). Another point to note is the importance of “sharing knowledge and co-ordination between the employees” since the Copenhagen Metro has a full 24-hour operation. This must be done to ensure that passengers experience the same high level of service and safety at any travelling time (Metro Service A/S, n.d.). This includes conducting compulsory briefings before change of shifts. It should be noted that the best operations employees are appointed for the job, and potential candidates are expected to undergo an intense three to six months training, which involves competency testing by writing of exams, and only those candidates that have passed the exams stand a chance to be appointed in this area of service within the company (Metro Service A/S, n.d.).
- Safety of passengers: Safety is another aspect that is important for operations staff in this company, and this is done by providing stewards that work around the clock to ensure that passengers are always feeling safe in the stations and trains (Metro Service A/S (n.d.). Furthermore, regular training is provided to

stewards on good service and prevention of violence. The safety of passengers is of utmost importance to the operator (Metro Service A/S, n.d.).

The roles and responsibilities under maintenance sections consist of the following aspects:

- Effective execution of planned maintenance and fast problem-solving: This is important as it can contribute to high operating stability and passenger satisfaction when problems are encountered (Metro Service A/S, n.d.). The operator is expected to plan for preventative and remedial maintenance while at the same time being aware of the need to continue providing a safe 24-hour service operation with minimal interruptions for the benefit of passengers.
- Management of interfaces in a reliable manner: This is one of the important roles played by the operator. A huge responsibility has been put on the operator to be responsible for most of the maintenance work, with a few works being outsourced (Metro Service A/S, n.d.). Clear responsibilities have been put in place for all departments within Metro Service A/S to ensure that maintenance work runs as smoothly as possible.
- Ongoing process optimisation: It is critical for the operator to minimise time spent on maintenance and maintain high service availability for the benefit of the passengers (Metro Service A/S, n.d.). According to Metro Service A/S (n.d.), optimisation does not only end in maintenance work but also goes as far as optimising the consumption of resources and minimising energy consumption, which entails reduced production waste and energy and water consumption.
- Knowledge and experience in maintenance: According to Metro Service A/S (n.d.), the operator ensures that employees with suitable skills and knowledge are employed and that ongoing education and training are provided to keep up with new technologies and continuous development of competencies. This includes the employment of new people. Based on the above, one can see that people are the important resources in this company.

As the operator, Metro Service A/S is also expected to measure its performance against the following Key Performance Indicators, as stated by Metro Service A/S (n.d.).

- Service Availability: This indicator is measured daily against the target of 98%.
- Passenger satisfaction: A monthly satisfaction analysis is conducted by an independent company, which has been outsourced by the operator to perform passenger satisfaction surveys.
- Number of km between disruptions: This indicator is important to measure disruptions as the operator must try to run trains without disruptions to ensure high levels of passenger satisfaction and service availability. It is reported that in 2018, the average for the year was just above 20,000 km (Metro Service A/S, n.d.).

## 4.5 The impact of the implementation of the system

### Land value capture

Copenhagen experienced economic difficulties during the 1980s. The 1970s and 1980s in Copenhagen proved to be one of the worst economic periods in this city. There was “high unemployment, industrial decline, decreasing population and lack of infrastructure investment” (Book, Eskilsson & Khan, 2010:386). According to Noring (2019:126), car owners living in Copenhagen decided to move to the suburbs, with students and pensioners being left behind in the city. This resulted in the loss of tax revenue from people (employed people) who had been making a big contribution towards tax revenue in Copenhagen compared to the pensioners and students. Also, an unemployment rate of 17.5% was recorded in Copenhagen during the mid to late 1980s, which forced people to move out of town, thus paying less tax contribution to Copenhagen (Noring, 2019:126). As a result of this, Copenhagen recorded an annual budget shortfall of $750 million during the late 1980s (Noring, 2019:126). Also, in the mid-1990s, the city was forced to halt social housing construction. This decision could be due to the above-mentioned events.

Consequently, Copenhagen was not able to follow the norm of funding infrastructure projects from its own budget because of its declining tax revenue collection. It had to look for other ways of funding a big public transport infrastructure project such as the Copenhagen Metro. Thus, the Copenhagen government decided to use land value capture to finance the Copenhagen Metro.

Noring (2019:128) explains that:

> …with the use of land value capture, local governments can increase their tax revenue based on the increased value of the land deriving from rezoning, infrastructure, or other public investments. In turn, the increased tax revenue can finance further public investments.

From this quote, it can be concluded that Copenhagen has been using land value capture to finance the construction of the Copenhagen Metro (Andersen & Jorgensen, 1995:20). This was a new way of financing transport infrastructure in Copenhagen.

City & Port is a public-private company and has played the following roles regarding the financing of the Copenhagen Metro, as stated by Noring (2019:126):

- City & Port uses land value capture to leverage the value of public assets through rezoning and infrastructure investments.
- City & Port enters Public-Private Partnerships (PPPs) that are frequently deployed by both public and private organizations.
- Lastly, City & Port establishes joint ventures with private investors and developers to manage developments and maximize profits, which is a finance mechanism commonly available to private organizations.

Being a public-private company enables City & Port to make its own decisions without interference from the government, and this has resulted in implementing large projects that favour urban regeneration without reliance on government funding. This company has also been given a mandate to always ensure revenue maximisation in all projects undertaken. As a result of this, Copenhagen is known as one of the top ten richest cities in the world (Noring, 2019:126).

Through land capture, private owners of residential and commercial properties within a 50-metre radius from the metro are also charged a certain amount of money per square metre for 60 years after the opening of a metro station, as stipulated in their contracts, says Noring (2019:131). By doing this, City & Port can collect additional revenue from these private owners. Noring (2019:131) further states that:

> City & Port borrows (generally with loans on favorable terms from the Denmark National Bank) based on the (increased) value of the land. CPH City & Port Development's AAA+ credit rating is a product of being publicly owned by the city of Copenhagen and the Danish national state. With such a credit rating, loans come at very favorable rates and, by operating like a private company, these loans are easily rent guaranteed in the private market.

Based on the above quote, it is easy to see the importance of land value capture to pay back the loans used for the Copenhagen metro construction.

**Transit-Oriented Development**

Knowles (2012:251) states that TOD dates to many years in countries such as the USA and the UK. According to Prayogi (2016:1), TOD is the opposite of urban sprawl as it seeks to encourage mixed development, with high-density buildings that are built around and/or next to transit systems. The mixed land use development, in most cases, includes both residential and non-residential developments where people rely heavily on transit systems rather than private cars to travel, and this includes walking (Prayogi, 2016:1). On the other hand, urban sprawl is characterised by mostly single houses of low density that are built farther away from the city centre, with heavy reliance on private cars to commute to work and access other amenities, such as schools, recreational and social services.

Copenhagen implemented the Finger Plan in the 1940s after the Second World War (Knowles, Ferbrache & Nikitas, 2020:3). As stated by Knowles (2012:252), the Finger Plan resulted in a pronounced TOD with a linear urban development pattern. This was done in conjunction with housing developments in the new towns during the 1960s. This shows that Copenhagen has been implementing TOD for many decades, since the mid1940s, mainly because of the development of towns connected to five rail transit corridors as determined by the Finger Plan. Copenhagen's TOD is also referred to as the first planned mid-20th-century rail (Knowles, Ferbrache & Nikitas, 2020:3).

The Ørestad New Town, which is situated about 10 minutes away from Copenhagen city centre, was established in the 1990s and formed part of the projects that were announced by the state and city of Copenhagen, as mentioned above. This led to the TOD development in this town, which is on Amager island, southeast of Copenhagen city core (Zeng, 2020:3). Knowles (2012:260) said that "Ørestad is an important and successful contemporary example of planned sustainable TOD". According to Knowles (2012:259), this town was designed to ensure high access to public transport and bicycles. This is further supported by Zeng (2020:4), who mentioned that "Copenhagen's 1995 master plan was launched to build Ørestad as a sustainable development with elevated Light Rail Transit (LRT) as the backbone of public transport".

International accessibility of Ørestad has led to the relocation of various companies to Ørestad next to metro stations and the Øresund motorway. According to Knowles (2012:259), one of these companies is a pharmaceutical company with some of its employees (about a third of employees) staying in Sweden, who can travel from Sweden to their workplace on a daily basis by using various modes of transport, such as metro, train and private cars. Knowles (2012:259) bases this relocation on the fact that:

> Ørestad station provides an interchange between Metro and the main railway services linking Copenhagen, Airport, and Malmö in Sweden via the Øresund Bridge and makes Ørestad City the most accessible site in the new town.

Another company that has relocated to Ørestad is the Danish Broadcasting Company, DR Byen, and it is reported that this communications company took the opportunity to move from different sites in Copenhagen city centre to this new town (Knowles, Ferbrache & Nikitas, 2020:6).

The Copenhagen metro facilitated mixed land use developments in Ørestad. In other words, the Copenhagen metro operating in this new town has had a positive impact on TOD and new urban development (Knowles, Ferbrache & Nikitas, 2020:6).

**Land use patterns**

Land use patterns have been positively affected by the Copenhagen Metro, as illustrated above, where the development of a new town, Ørestad, facilitated TOD. According to Book, Eskilsson and Khan (2010:388), the master plan of the Ørestad new town, which was completed by 1995, stated that land uses in this new town had to consist of 60%, 20% and 20% of offices, houses and facilities, respectively. This meant that more than 50% of land uses in this town had to be offices. As a result of this, companies with offices from various sites were able to move offices to Ørestad.

As far back as 2000, the housing market took off in Copenhagen, resulting in sales of land in Ørestad for housing, office space and other developments (Book, Eskilsson and Khan, 2010:388). Furthermore, Book, Eskilsson and Khan (2010:388) report that the 2009 records reveal that there were about 5000 people living in Ørestad with 10,000 workplaces. According to Knowles (2012:257), Ørestad New Town plans were to create 60–80,000 jobs and build 20,000 education places and dwellings for 20,000 people by 2025.

Book, Eskilsson and Khan (2010:389) argue that the construction of the metro in Ørestad before land use development had a positive impact on land use planning and development. It should be noted that the revenue generated from land sales in Ørestad was used to pay for the loans taken to construct the metro. Another point to note is that, had the metro construction been slow, the sale and price of land would have also been negatively affected by this, as pointed out by Book, Eskilsson and Khan (2010:389). In other words, the metro facilitated land sales in Ørestad, which then led to the mixed development of the town.

**The impact on travel behaviour after project implementation**

There has been a positive impact on travel behaviour in Copenhagen and surrounding new towns after the start of operations of the Copenhagen metro in Copenhagen and surrounding towns, such as Ørestad. People have been able to travel with ease to

different towns using the Copenhagen Metro. This includes people who are staying in Sweden who have been able to use various modes of transport including the Copenhagen Metro to travel to their workplaces, especially those situated in Ørestad.

## 4.6 Measures adopted to attract land use developments to desired locations and to discourage land use developments from undesirable locations

The construction of the metro with its stations and highways and being closer to international borders such as the Sweden border has attracted land use development in Ørestad town. As mentioned above, this has led to the relocation of big businesses and public companies such as the Danish Broadcasting Corporation and some sections of the University of Copenhagen to Ørestad (Knowles, 2012:260).

Land use development from undesirable land locations in the case of Copenhagen refers to land use developments next to areas such as landfills, power stations, roads and protected areas. The Finger Plan has always protected the development of green areas or wedges in between the towns that have developed over the years. The green wedges or areas are restricted, and no construction is allowed in those areas. According to Sorensen and Torfing (2019:221), this plan has prevented the construction of new neighbourhoods and shopping malls in the green wedges that separate the five fingers. This has also enabled Copenhagen residents to enjoy nature and participate in outdoor activities provided within these green wedges, which have remained undeveloped for over 70 years. Even with the developments experienced by Copenhagen Metro expansions through towns, there has never been a proposal to build on the green wedges. Over the years, young planners and land developers have always been guided against making any attempts for urban developments within the green wedges, and this has been done by educating them on the ideas and principles of the Finger Plan (Sorensen & Torfing, 2019:222).

## 4.7 Chapter conclusion

This chapter has discussed the Copenhagen case study and provided detailed information on planning, institutional arrangements, impact of the implementation of the Copenhagen Metro on TOD, land value capture, land use patterns, and travel behaviour. It also discussed measures adopted to attract land use developments to desired locations and to discourage land use developments from undesirable locations. The funding and operational arrangements of this project were also highlighted. Positive effects have been realised through the implementation of this project, as outlined above. The Copenhagen case study has shown the important role played by the 1947 Finger Plan of Copenhagen in shaping and influencing the urban form of this city.

# 5. CURITIBA CASE STUDY

## 5.1 Introduction

A brief background on Curitiba will be provided below. This will be followed by a discussion on planning and institutional arrangements in this city, and how the implementation of the Curitiba BRT project affected TOD, land value capture, land use patterns, and travel behaviour.

According to Macedo (2004:538), Curitiba was founded in 1693 and became a city in 1842 and ended up being the capital of Parana in 1854. Brazil is a country with 26 states and one federal district (Whereig.com, n.d.).

Figure 5.1 shows the map of Brazil with major and well-known cities such as Rio de Janeiro and São Paulo, including Curitiba.

**Figure 5.1: Map of Brazil with major cities**

Source: CIA (2004) [15 July 2024]

Curitiba's urban form was once irregular and followed topographical features in the early 1800s, and changes that started from the mid to late 1800s when the Law of Lands paved the way for people to have private land property (Macedo, 2004:538). The abolition of slavery enabled Curitiba to attract immigrants from Europe who became mostly agricultural labourers in Curitiba. The economy of this city was also growing, and people were attracted to it because of job opportunities. Because of this, the town welcomed people from Asian and Arabic countries, including those from different parts of Brazil (Macedo, 2004:538).

Curitiba has experienced the highest growth and urbanisation rates during the past 30 years in Brazil, as stated by Macedo (2004:539), and this was partly due to industrialisation and, later, immigration. It should be noted the above information on growth and urbanisation rates in Curitiba is only related to 30 years as referenced in 2004, and is not the latest information of 2024 (50 years). According to Macedo (2004:539), Curitiba was "the seventh largest city in Brazil", with Parana becoming the sixth largest state, with a population of 1.6 million and 9.5 million, respectively.

According to Prestes, Ultramari and Caetano (2022:1), Curitiba has, over the years, gained worldwide recognition for being at the forefront of urban planning by prioritising public transport over private transport and this has led to the transfer and circulation of ideas to other countries over the years. For example, this circulation of ideas includes study tours conducted by South African cities before and during the implementation of their respective BRT projects.

## 5.2. The planning, and institutional arrangements for public transport before project implementation: Curitiba Bus Rapid Transit

The first planning in Curitiba took place in 1857 when the city was changed from a circular pattern to a quadrangular pattern, and this happened when Curitiba became a capital city of Parana Province in Brazil, as alluded by Macedo (2004:540). With ongoing population growth, there was also a need for Curitiba to accommodate sanitation, with the first sanitation project being completed in 1886, which came with the development of the first public park in this city, as reported by Macedo (2004:540). It is reported that planning in the 1930s focused on commercial, residential and industrial planning and was heavily influenced by European standards (Macedo, 2004:540).

With regard to transport planning, the French influence in this city led to the preparation of the Agache Plan between 1941 and 1943. According to Macedo (2004:541), this plan promoted:

> …a radial road system departing from downtown and directing commercial, industrial, residential and institutional activities to secondary centres structured by function.

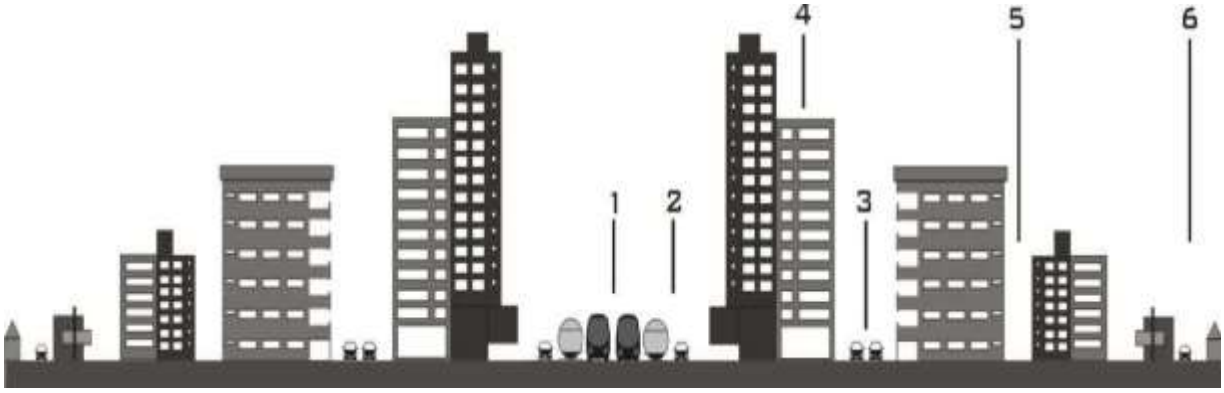
The above plan was implemented until the 1960s, but not in the way it was planned due to economic problems and the rapid growth of the city, as noted by Macedo (2004:541). According to Macedo (2004:541), talks on the revision of the Agache Plan started in the early 1960s and the revised plan, known as the Master Plan, was launched by the City Council in June 1966. This Master Plan led to the establishment of two institutions, which are the Affordable Housing Company of Curitiba (Cohab-CT) and the Urban Research and Planning Institute of Curitiba (IPPUC).

Cohab-CT is responsible for the financing, planning, construction and ensuring distribution of affordable housing units to low-income families (Macedo, 2004:543). This authority has, over the years, tried to provide affordable housing to Curitiba people, but it has not been an easy task considering the national problem of housing shortages, with a national housing deficit of over 80% in the early 2000s (Macedo, 2004:543). This deficit has also led to an "ever-growing number of informal

settlements” in the periphery of this city as pointed out by Macedo (2004:542). All this makes it clear that Brazil is one of the developing countries that is still grappling with a deficit in terms of providing low-income houses. The same problem is being experienced in South Africa when it comes to the provision of low-income and affordable houses.

According to Macedo (2004:542), the Master Plan proposed a change in the radial system by having transit-based axes to direct the growth of the city in a linear shape. Figure 5.2 shows the 1966 Master Plan with traffic lane allocations and buildings built according to density.

**Figure 5.2: 1966 Curitiba Master Plan**




Source: Duarte and Ultramari (2012: 185)

1: Bus corridor
2: Local traffic lanes
3: Fast traffic lane
4: High density
5: Medium density
6: Low density

Furthermore, Macedo (2004:542) reports that this plan included integrated land use transport planning wherein land use patterns were integrated with roadway systems and transit networks with higher densities and mixed use being proposed along the main transport corridors, and the higher densities decreased with increasing distance from the main transport corridors. The above is shown according to annotations from 1 to 6 as indicated in Figure 5.2. As illustrated in Figure 5.2, the bus corridor is on the first lane and in the middle of the city and transport of low density is furthest away from the city centre. Integrated land use transport planning refers to a relationship between land use patterns and transport systems, which ensures that land use patterns are developed while at the same time providing transport infrastructure and services to support the land use patterns in a particular area. In the case of residential development, a new residential area with schools, clinics, libraries and shops will have appropriate road transport infrastructure and services, such as roads that are in a good condition, minibus taxis and municipal buses.

This integrated plan also recommended the creation of open green spaces, “renewed urban land and recreational facilities and historic preservation initiatives” (Macedo, 2004:542).

**What were the planning and institutional frameworks?**

According to Macedo (2004:541), the IPPUC was established to oversee the implementation of all projects including the Master Plan and ensure the coordination of a comprehensive development plan. With the above roles being clearly laid out for this institution, the Curitiba government saw it fit to have the IPPUC located in the office of the mayor. This was even though IPPUC was an independent agency. According to Macedo (2004:541), technical and managerial staff members appointed in this agency were political appointments, and because of this, the implementation of projects under the IPPUC depended on the interests of the then-governing administration and projects were not always implemented as per the Agache Plan. The above scenario meant that city planning was influenced by the office of the mayor.

Macedo (2004:541) cites the following key events that happened between different timeless in Curitiba from 1971 to 1983:

- From 1971 to 1975: industrialisation of the state’s capital, which led to the establishment of the Industrial City of Curitiba.
- From 1975 to 1979: changes made in zoning and land use legislation including limited residential development towards the fringes of the urban core and promotion of higher densities and mixed-use development next to major transit corridors.
- From 1979 to 1983: prioritisation of transport planning in Curitiba.

Macedo (2004:541) is also of the view that the political connection of the IPPUC slowed down the development in some areas and encouraged unfair benefits to those people who were closer to the political administration.

It is reported that a new City Plan was enacted in 1985, during the time (between 1983 and 1988) when there was a different political administration, and this Plan called for decentralisation of decision processes and encouraged participation from members of the public to discourage centralisation of powers as it had been happening during the previous administration (Macedo, 2004:541). However, this political administration was in power for only one term and could not do much as the same political administration that had been in office between 1971 and 1983 came back to power in 1989.

Urbanização de Curitiba S.A (URBS) is according to Law 12.597/2008 responsible for the regulation, management, operation, planning and supervision of the Collective Passenger Transport System of the Municipality of Curitiba-PR as explained by URBS (n.d.). Furthermore, the functions of URBS include the following as mentioned by URBS (n.d.).:

- Hiring of the operating companies.
- Defining itineraries, stopping points and schedules.
- Determining types and characteristics of vehicles.
- Inspecting the fleet and supervising the services.

- Calculating the technical tariff.
- Controlling the mileage and passengers.
- Managing the Transport Card.

Based on the functions mentioned above, operations of the BRT system are privatised even though URBS is expected to oversee the operations as per the functions.

**How did these frameworks facilitate the implementation of the project?**

It is reported by Lindau, Hidalgo and Facchini (2010:275) that there had been plans in Curitiba during the early 1970s to implement the LRT system, but this plan was unsuccessful due to high costs of the LRT. Then, the next possible plan that seemed to be viable for Curitiba was the BRT system, which in its early stages was just "a trunk-and-feeder system" that "operated on segregated median flow lanes at the central component of axial transit ways" Lindau, Hidalgo and Facchini (2010:275).

The public transport system in Curitiba consists mainly of buses and this city is best known worldwide for its successful BRT implementation. According to Macedo (2004:544), the bus transit system started in 1974 in Curitiba, with "north-south routes connecting downtown" and operating on an exclusive lane. The first bus was called the Express Line Bus and this bus was inspired by the 1969 Preliminary Metro System Study, which had been prepared to articulate the recommendations of the 1965 Master Plan (Prestes, Ultramari & Caetano, 2022:3). It should also be noted that the involvement of the multidisciplinary team consisting of "architects, engineers, economists, geographers, and sociologists; and the creation of IPPUC" was a catalyst to the successful implementation of the Express Line Bus as pointed out by (Prestes, Ultramari & Caetano, 2022:3).

There were major transformations and improvements on the system over the years, with the east-west routes being implemented and this eventually led to the establishment of the Integrated Transportation Network also known as RIT-Rede Integrada de Transportes in Curitiba as reported by Macedo (2004:544).

The Direct Line was introduced in 1991, just after the 1980s oil crises. This bus operated similar to the metro with prepaid tickets and also introduced tube stations. (Prestes, Ultramari & Caetano, 2015:3). Sharing of information and ideas was key to the implementation of the Direct Line bus and the construction of the tube stations in Curitiba. The reasons behind the introduction of the Direct Line were to reduce the demand for public transport from the Express Line and extend the life cycle of "the existing bus system along the city's structural axes" (Prestes, Ultramari & Caetano, 2022:6). It is further reported that the Direct Line was characterised by increased speed and thus reduction in operational costs when compared to the Express Line Bus as outlined by Prestes, Ultramari and Caetano (20:6).

The above system upgrades ended up in the full BRT system in Curitiba, which is characterised, for example, by tube stations and a single flat fare for ease of access to the system at terminals as explained by Lindau, Hidalgo and Facchini (2010b:275). With the single fare system, passengers can access different bus lines in Curitiba and thus save on transport costs.

Lindau, Hidalgo and Facchini (2010:275) pointed out the following:

> A single flat fare enabled a cross subsidy between short and long displacements by allowing users to interchange between trunk-and-feeder services at terminals and tube stations.

**Figure 5.3: Curitiba Tube Station**

Source: Ortiz (2013) CC-BY-SA-3.0

Source: Ortiz (2006) CC-BY-SA

Figure 5.3 shows two photos of the inside and outside of the tube station. In one photo, a waiting area can be seen inside the tube station. It also shows that the access and exit points of the bus are on the same level as the station, allowing ease of access for all passengers, especially those using wheelchairs.

## 5.3 The nature of the transport investment

The nature of the transport investment is described below in two sections, which are project sponsor and structure of the investment.

### Who was the project sponsor?

The project sponsor for Phase 1 of BRT in the 1970s was government. It is reported that the then mayor of Curitiba, Mayor Jaime Lerner, experienced difficulties with regard to funding the BRT system and the municipality had to use its own funds to ensure that Phase 1 of this project was implemented as explained by the Institute for Transportation and Development Policy (ITDP, n.d.). The success of Phase 1 thus enabled the banking sector, in this case, the Inter-American Development Bank (IADB), to realise that this was a financially viable project and agreed to fund Phase 2 of BRT in Curitiba (ITDP, n.d.).

The Green Line is a 31km corridor with integrated express and passing lanes (ITDP, n.d.). There is no literature information about the funding of other Phases of BRT in Curitiba besides the funding for the Lean Verde, also known as the Green Line, by multiple funding streams as highlighted below under the structure of the investment.

According to the Institute for Transportation and Development Policy (ITDP, n.d.), the government in Curitiba ensured that projects of national significance are funded by once-off grants provided by government.

### How is the investment structured?

With Phase 2 being financed by IADB, one of the terms and conditions of this financing was that the city had to repay the loan directly to the bank (ITDP, n.d.)

The following can be said about the financing of the Green Line (ITDP, n.d.):

> It cost roughly US$241.5 million, of which US$74.9 million came from a national government grant, US$144.9 million or 60 percent came from the municipality, and 9 percent or US$21 million came from the vehicle operators for vehicle procurement. Some 40 percent of the total cost was debt financed, of which the US$74.9 million paid by the national government was financed by a loan from the IDB and the French Development Agency (AFD), some 7 percent or US$14.7 million (for the vehicle procurement) was financed by commercial banks, and some US$7.2 million or 3 percent was financed by the Caixa Economica Federal.

Based on the above, it is clear that as the BRT system continued to develop in Curitiba, public and private sector funding was used to fund this project. The 60% funding of the Green Line project by the national government of Brazil is an indication of government's commitment towards the development of the public transport system in Curitiba.

### Are there any loan payment arrangements?

At some point, loan payment arrangements were made for Phase 2 and other phases including the Green Line. The author is of the view that there were loan repayment arrangements for the development of the Green Line, as 40% of the costs for the development of this project was funded by IDB, AFD, and the Caixa Economica Federal as illustrated above.

## 5.4 The operational arrangements of the system

The operations of the BRT system are outsourced, with URBS being responsible for the appointment of these companies. This is confirmed by Pienaar, Krynauw and Perold (2005:364), who state that several operators are appointed by URBS and that operators are compensated based on the kilometres travelled. Another point to take note of is that a single fare applies to all passengers using the BRT buses as indicated above.

### Who is the operator of the system?

The system is currently being operated by operators who are appointed and managed by URBS (n.d.). The operating companies are listed in Table 5.1.

Table 5.1: Opening of the system – BRT

| LOT 1– PUNCTUAL CONSORTIUM | LOT 2 – TRANSBUS CONSORTIUM | LOT 3 – PIONEER CONSORTIUM |
|---|---|---|
| PUBLIC TRANSPORT GLORIA LTDA 1 | AUTO VIAÇÃO REDENTOR LTDA | VIAÇÃO CIDADE SORRISO LTDA |
| TRANSPORTE COLETIVO GLÓRIA LTDA | EXPRESSO AZUL / URBANA | VIAÇÃO TAMANDARÉ LTDA / URBANA |
| AUTO VIAÇÃO MERCÊS | ARAUCÁRIA TRANSPORTE COLETIVO LTDA / URBANA | CCD TRANSPORTE COLETIVO S.A. |
| AUTO VIAÇÃO SANTO ANTONIO LTDA | | AUTO VIAÇÃO SÃO JOSÉ LTDA / URBANA |

Source: urbs.curitiba.pr.gov.br [13 December 2023]

From Table 5.1, it is evident that the operations of the BRT system in Curitiba are run by several companies. Currently, there are 11 operators of the BRT system.

**What are the roles and responsibilities of the operator?**

The roles and responsibilities of the operators, as outlined by Pienaar, Krynauw and Perold (2005:368), are to acquire buses as per the prescriptions of URBS, employment and payment of all operations staff, maintenance of buses including cleanliness and ensuring bus operations are conducted as per service orders from URBS.

Based on the above roles and responsibilities, it is evident that the operators are expected to work closely with URBS to ensure that the operations are run in an efficient and effective manner in this city.

## 5.5 The impact of the implementation of the system

**Land value capture**

The case of land value capture in Curitiba is described by Neville et al. (2016:4) as being realised during the development of the Green Line. This development was characterised by increases in land values along the corridor, which assisted with the development of “multiple low density industrial sites”, as stated by Campbell et al. (2016:4). It was envisaged that the revenue collected from sale of development rights would assist with funding of the Green Line. According to Neville et al. (2016:4), any company that wishes to buy and develop land along the corridor is required to buy a development certificate, also known as CEPAC (certificate of additional development potential), from the city of Curitiba. In other words, the city is responsible for land development in Curitiba.

Duarte and Ultramari (2012: 189) state that the land values along the corridors are the most expensive due to them having a higher building potential compared to land that is further away from the corridors.

**Transit-Oriented Development**

The Master Plan of Curitiba that was approved in 1966 promoted growth along linear axes with high population density and mass public transport the axis, which resulted in the development of north and south corridors and later on east and west corridors in Curitiba (Duarte & Ultramari, 2012:183). Furthermore, the aim of “the transit axes was to stimulate the use of public transportation” and optimise “public urban

infrastructure", as alluded by Duarte and Ultramari (2012:184). The above-mentioned corridors have proven to have the highest concentration of people, diverse services and facilities, which are typical characteristics of TOD (Duarte & Ultramari, 2012:183).

Cervero and Dai (2014:130) reported that medium and large developments in Curitiba had to be built along the transit corridors, thus shaping the urban growth of the city. The above also shows that Curitiba BRT investments have encouraged TOD in this city.

**Land use patterns**

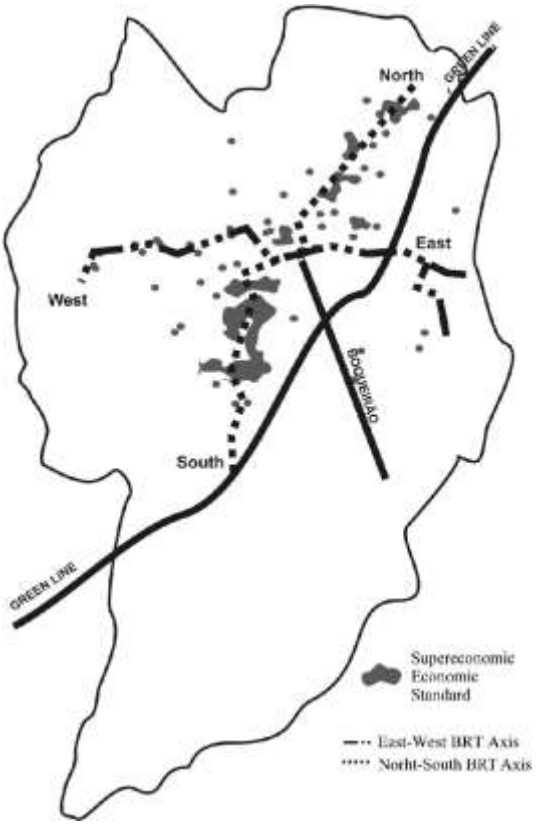
Curitiba promoted integrated land use transport planning by limiting growth towards the centre and "encouraging commercial growth along the transport arteries" coming from the city centre, as explained by Goodman, Laube and Schwenk (2005:76). Furthermore, the typical congested downtown centre, which is normally found in most towns is not visible in Curitiba since there are pedestrian streets at the centre and there is land zoning for high-density buildings within two blocks of the transit arteries, which acts as a way of encouraging more people living in those areas to use the BRT system (Goodman, Laube & Schwenk, 2006:76). Also, new retail growth has been found along transit corridors while discouraging centres that are car friendly to encourage people to use public transport (Goodman, Laube & Schwenk, 2006:76). Duarte and Ultramari (2012:183) confirmed that linear TOD, such as the one found in Curitiba enabled land use that promoted for example public facilities, and housing along transport corridors.

A study by Smith and Raemaekers (1998:233) mentioned that land use patterns in Curitiba considered the following aspects: settlement shape, densities of development and location of services relative to one another. These aspects are briefly described as follows:

- Settlement shape

With regard to settlement shape, Smith and Raemaekers (1998:237) explained that Curitiba has a five-spoke irregular star as shown in Figure 5.4. As indicated in Figure 5.4, "the north and south lines form the longest spokes in terms of development", while "the east and west lines are shorter in terms of planned high-density development" (Smith & Raemaekers,1998:237). It is further reported by Smith and Raemaekers (1998:237) that the fifth spoke, known as the Boqueirfio line, protrudes "from the old city core in a south easterly direction" and was not planned but was due to a response to the "demand from high immigration to this area".

Figure 5.4: Curitiba five-spoke irregular star




Source: Duarte and Ultramari (2012:190)

According to Smith and Raemaekers (1990:239), the settlement shape in Curitiba has followed the shape of the public transport network and this has led to the integration of land use and transport planning. With the above being said, Curitiba has six different types of bus lines that form the Integrated Transport Network (RIT). These bus lines are described in Table 5.2.

**Table 5.2: Types of bus lines in Curitiba**

| Type | Description |
|---|---|
| Express | Red bus: standard or articulated and travelling along the busways in the structural sectors |
| Feeder | Orange bus: standard, linking residential areas with the interchange terminals, allowing transfer of passengers to express to inter-district buses |
| Inter-district | Green bus: links city districts without crossing the centre |
| Direct | Silver bus: designed to be boarded only from tube stations and provides a fast service with few stops and direct buses running along the fast-outer roads of the trinary system |
| Bi-articulated | Red bus: specially designed long buses carrying up to 270 passengers can also be boarded from tube stations and from special platforms at the interchanged terminals |
| Conventional | Yellow bus: standard and provides a direct link between outer districts and the city centre |

Source: Smith and Raemaekers (1998: 239)

Based on the above, it is evident that land use patterns in Curitiba have been influenced or shaped by the implementation of BRT along the corridors.

- Densities of development

This section attempts to look at the overall density of Curitiba. Density in Curitiba was reported at 30.5 persons/hectare in 1980 and slightly higher than the one recorded by

Newman and Kenworthy of 30 persons/hectare Smith and Raemaekers (1990:242). Furthermore, the findings by Newman and Kenworthy, as reported by Smith and Raemaekers (1990:242), are that Curitiba is in the same cluster as European cities that have medium to high densities and low fuel consumption per capita.

Based on the study conducted by Newman and Kenworthy, Curitiba was found to be a city that is strongly centralised with a good public transport system. The above features of Curitiba further classified this city to fall in the middle group of cities such as New York and Copenhagen, as noted by Smith and Raemaekers (1990:244).

- Location of services

According to Smith and Raemaekers (1990:244), the plan for Curitiba was for linear corridors to have mixed land use for services and residential development, with industrial areas being about 10 km from the old city centre, and the services had to be situated close to the trunk roads. This plan does not seem to have taken shape in 1985 when it was reported that about 26.2% of jobs were found in the city centre while 55.3% of jobs were found in the inner area, as reported by Newman and Kenworthy (Smith & Raemaekers, 1990:244).

**The impact on travel behaviour after project implementation**

The implementation of the BRT system in Curitiba and continuous improvement in this system over the past 40 years has enabled people to move from one side of the city to another side by transferring between buses using a single fare system. This system is very accommodating for workers in Curitiba. Macedo (2004:545) stated that workers in Curitiba are more mobile compared to those staying in other Brazilian cities. This is due to the affordability of the BRT system, especially for workers who mostly get transport subsidies from their employers, which somehow eases the burden of high transport costs in a country also known for low wages. Workers get 6% discounts from their salaries for BRT passes thus reducing their transport costs and increasing their mobility (Macedo, 2004:545). It should be noted the above information on travel behaviour in Curitiba is only related to 40 years as referenced in 2004, and is therefore not the latest information of 2024 (60 years).

## 5.6 The measures adopted to attract land use developments to desired locations and to discourage land use developments from undesirable locations

To encourage land use developments along transit corridors, land is zoned for high-density housing within two blocks of the transit arteries as reported by Goodman, Laube and Schwenk (2005:76). With this measure being put in place, the use of public transport, in this case, BRT, is guaranteed for people living in high-density areas.

To reduce motorists in the city centre since planners wanted to discourage auto-oriented centres has meant that the city provides limited parking space to force motorists to use public transport (Goodman, Laube & Schwenk, 2006:76). Another measure that was taken by the city officials was to build retail shops along the transit corridors so that people do their shopping in those shops. Closure of streets to cars and conversion of some streets to pedestrian streets has also been reported in Curitiba

as a way of discouraging cars in the city centre and encouraging people to walk and use BRT services.

It should be noted that linear development has been encouraged over time to reduce the need for people to come to the downtown area. With this development, the downtown area is no longer an important area to travel to daily. In this case, rush hour has been characterised by heavy commute in both directions along the transit arteries, as reported by Goodman, Laube and Schwenk (2006:76). The introduction of BRT in Curitiba has influenced modal shift from car travel to bus travel (Goodman, Laube & Schwenk, 2006:76). Bus travel is the most preferred mode of transport in Curitiba and is also affordable even to the low skilled and low-income workers as illustrated above.

## 5.7 Chapter conclusion

This chapter discussed a case study of Curitiba and how the famous BRT project, which has seen continuous developments and upgrades over the years, impacted land value capture, TOD and land use patterns. From the data collected, it became clear that Curitiba has promoted land use development along transit corridors, and land value capture has been used to implement other BRT projects.

The story of Curitiba BRT has been retold repeatedly, but it still inspires many countries, including South African cities, to implement their own BRT systems.

# 6. HONG KONG CASE STUDY

## 6.1 Introduction

This section starts with a brief background on Hong Kong, which is followed by a discussion of planning and institutional arrangements in Hong Kong and how the metro rail transit project impacted land use transport in this city.

Hong Kong is a city that was a British colony for over 150 years, excluding the period from 1941 to 1945, wherein it was under Japanese occupation and thereafter went back to being a British colony. Honk Kong was handed back to China on 1 July 1997 when Hong Kong became the Special Administration Region (SAR) of the People's Republic of China (PRC) (Cullinane and Cullinane, 2003:279).

According to Cullinane and Cullinane (2003:279), the 1997 handover of Hong Kong to the PRC has since led to Hong Kong being independent from the PRC in many matters except in defence and foreign policy matters to ensure its stability and prosperity as a city. Cullinane and Cullinane (2003:279) point out that Hong Kong operates "under the principle of one country two systems". Hong Kong is separated by a border from mainland China and Hong Kong's residents are required to obtain a 10-year visa to visit mainland China. Mainland China residents are also expected to obtain a visa to visit Hong Kong, and this is not an easy exercise except for organised tours, as reported by Cullinane and Cullinane (2003:281).

The characteristics of Hong Kong, as described by Cullinane and Cullinane (2003:280), are as follows: total area of Hong Kong is "1100 $km^2$ divided into four main areas"; mountainous city with 25% of its land being urbanised and 11% of land is built up; up to "40% of its land area is designated as country parks"; and the city is very compact with high-rise buildings leading. The four main areas of Hong Kong are Hong Kong Island, Kowloon Peninsula, New Territories and Outlying Islands (Cullinane & Cullinane, 2003:280).

Hong Kong is one of the cities in the world where government has put more emphasis on social housing programmes, which has seen an increase in the number of high-rise buildings to accommodate its citizens with an increase in the number of households and a decrease in the size of households. This has been done to accommodate the increasing demand for housing in this high-density and compact city. In this case, the private sector has worked hand in hand with government to ensure that housing needs for Hong Kong citizens are taken care of, and government has done this by providing housing allowances, subsidised home ownership flats and loans (Cullinane & Cullinane, 2003:280). Literature review shows that these housing programmes have been implemented continuously over the years to establish some balance in a city that has been experiencing political uncertainty for some years.

## 6.2 The planning and institutional arrangements for public transport before project implementation: The Mass Transit Rail

Hong Kong is a city that developed from the waterfronts. There were harbour reclamations and landfills, which led to growth and development of Hong Kong (Suzuki et al., 2015:71). The change in the sovereignty of this city because of it being handed back to China in 1997 led to an increase in population to about 7.1 million in 2015, with a continuous huge attraction from people in neighbouring cities and towns such as Hong Kong Island, the Kowloon Peninsula, and the New Territories and Islands (Suzuki et al., 2015:72). This has attracted more people within the city, thus making Hong Kong one of the most populated cities in the world. This is because Hong Kong has a total build-up area of 23.7% of the total area, with 7% being suitable for residential development (Hui & Yu, 2013:201). The build-up area is still under the limit, which is 25%. However, this is a challenge to a city such as Hong Kong, which keeps on experiencing an increase in population growth and this will need constant monitoring from government.

### What were the planning and institutional frameworks?

Hong Kong has, over the years since the 1940s, relied on “Territorial Development Strategies to address competing demands for land for housing, commercial, transport, recreation, nature conservation, heritage preservation, and other community needs” (Suzuki et al., 2015:72).

The Planning Department for the Town Planning Board in Hong Kong is responsible for planning matters in this city. According to Suzuki et al. (2015:74), “the outline zoning plans and development permission area plans”, which act as a “temporary measure for certain nonurban areas”, must be prepared by this Planning Department for approval by the Town Planning Board. Furthermore, this Board is responsible for the introduction of comprehensive development areas as a way of encouraging urban design and development of an area “through involvement of multiple land parcels and property owners and including public open space and local community facilities” (Suzuki et al., 2015:74).

Another contribution of the Planning Department has been the development of Hong Kong Planning Standards and Guidelines. These documents have played a role in facilitating social and economic development through land use, and this is done by stipulating measures related to, for example, residential densities, retail, recreational and community facilities, and utility services (Suzuki et al., 2015:74). Then there is also another body known as the Urban Renewal Authority, which is tasked with the preparations of development scheme plans for developing old areas, according to Suzuki et al. (2015:74). This shows commitment of the city to being at the forefront of city renewal projects.

The first report to propose the implementation of a mass transit project is known as the Hong Kong Mass Transport Study and was completed in 1967. It was followed by another report known as the Hong Kong Mass Transit Further Studies, which was completed and submitted in 1970 (University College Oxford, n.d.).

**How did these frameworks facilitate the implementation of the project?**

It is reported that delays were experienced with regard to the implementation of an MTR project after the submission of the above-mentioned transport study reports. Then, in 1972, the appointment of a new Financial Secretary who was in support of this project resurrected the implementation plans for the MTR project (University College Oxford, n.d.).

To pave the way for the implementation of the MTR, the Hong Kong government established a Mass Transit Railway Steering Committee, which consisted of officials from Public Works and other senior officials (University College Oxford, n.d.). The role of this committee was to oversee the implementation of the MTR project. Thereafter, a Japanese consortium was appointed to design and construct "a line from Kwun Tong in Kowloon to the Central District on Hong Kong Island and a branch line from Mong Kok to Lai Chi Kok" (University College Oxford, n.d.).

It is further reported that delays were experienced during the design stage since the Japanese consortium could not meet the design requirements of the Hong Kong government, and later, in 1974, the Japanese consortium ended up cancelling their services due to increases in construction costs (University College Oxford, n.d.). According to University College Oxford (n.d.), the scope of work changed to save on construction costs, and this resulted in the construction of a single line from Kwun Tong to Central, together with the maintenance depot at Kowloon Bay. Construction work started in June 1975. The MTR project was opened for public use in December 1979 and was followed by further extensions.

Then, in 1975, the Hong Kong government established the Mass Transit Rail Corporation (MTR Corporation), which was a wholly owned company by the Hong Kong government. The ownership completely changed in June 2000 after Hong Kong SAR sold 23% of its shares to a private investor (MTR Corporation, n.d.). Furthermore, another change was observed in this company when the MTR Corporation took over the operations of another government-owned company, the Kowloon-Canton Railway Corporation, which merged with the MTR Corporation in December 2007 (MTR Corporation, n.d.).

The Hong Kong government owns 77% of the MTR Corporation. According to the Housing and Transport Bureau (2017:1), the Hong Kong government has conducted three comprehensive transport studies (CTS) since 1976 with the aim of outlining the strategic plans for transport planning and development. This included the development of infrastructure plans.

## 6.3 The nature of the transport investment

The nature of the transport investment is described below in terms of the project sponsor and the structure of the investment.

**Who was the project sponsor?**

The Hong Kong government has been the major sponsor of this project since its inception, as government still owns the largest share of MTR Corporation.

As a result of changes that happened in the early 2000s, the MTR Corporation is now a publicly owned company and there is currently a PPP between government and a private company (Li & Love, 2022:4). In this case, a joint venture exists through the involvement of both government and private company in the funding and operations of the MTR project. Since the Hong Kong government owns the largest share of this company, it is therefore responsible for providing supervision and support to the company as further reported by Li and Love (2022:9). The MTR Corporation is also managed by a Chief Executive Officer and Executive Committee (MTR Corporation, n.d.). To ensure that corporate governance exists within this company, a Board has been appointed, and it is reported that the Hong Kong government is responsible for policy guidance and privileges to support the delivery of MTR services (Li & Love, 2022:9). This has been done for example by increasing car ownership costs to promote the use of public transport services such as MTR.

**How is the investment structured?**

Cervero and Murakami (2009:2042) explain that the MTR Corporation does not receive any funding from government for rail infrastructure but only receives exclusive development rights for land above and adjacent to its stations. It is further reported that MTR Corporation gets these "development rights at a land premium based on the "before rail" market price and when a public tender is prepared, allocates property development rights to cooperative developers" (Li & Love, 2022:6). Furthermore, the profits made from the sale of the property developments by corporate developers are then shared with MTR Corporation on a case by case basis (Li & Love, 2022:6). These profits are then used for rail infrastructure development. According to Li and Love (2022:6), project risks and land premiums are borne by the corporate developers. In other words, the MTR Corporation shields itself from any risks associated with property development projects. Cervero and Murakami (2022:2024) point out that:

> The differences between land values 'with' versus 'without' rail services are often substantial, easily covering the cost of railway investments. When bargaining, MTR Corporation also negotiates a share of future property development profits and/or a co-ownership position from the highest bidder. Thus, MTR Corporation receives a 'front end' payment for land and a 'back end' share of revenues and assets in-kind.

Based on the above, it is clear that land value capture plays a key role in the financing of the MTR Corporation. This financing strategy has worked very well over the years for the MTR Corporation with the support of government.

Of interest to note is that the MTR Corporation derives its profits from various businesses it operates in Hong Kong besides property development. These businesses are transport operations, station commercial businesses, and property rental management businesses (Li & Love, 2009:9). The above-mentioned businesses form part of land value capture.

**Are there any loan payment arrangements?**

Based on literature reviewed, there are no loan payment arrangements in the MTR once rail infrastructure projects are financed through profits made from LVC across Hong Kong. This has proven to be a reliable source of funding for the MTR Corporation since the mid-1970s with the support of government.

The MTR Corporation operates on commercial principles, financing and operating railway services that are not only self-supporting but also yield a net return on investment.

## 6.4 The operational arrangements of the system

The operational arrangements of the MTR, the operator of the system and the roles and responsibilities of the operator are discussed below.

### Who is the operator of the system?

As mentioned above, the MTR Corporation is responsible for the operations of passenger rail services in Hong Kong. The private investor of the MTR Corporation is a property developer.

### What are the roles and responsibilities of the operator?

The MTR Corporation is responsible for the operations of the rail network that consists of nine railway lines serving Hong Kong Island, Kowloon and the New Territories, and a Light Rail network that serves the local communities of Tuen Mun and Yuen Long in the New Territories (MTR Corporation, n.d.). According to Verougstraete and Zeng (2014), the rail network system operated by the MTR Corporation is 218.2 km in length, with 84 stations and 68 light rail stops.

## 6.5 The impact of the implementation of the system

### Land value capture

Property development in Hong Kong through property developers has played an important role in land value capture, which is heavily implemented by the MTR Corporation. The MTR Corporation has applied the Rail and Property Model (R + P Model) to develop properties which make profits that are used for the construction of rail infrastructure and operations. Through this model, the high densities found in Hong Kong have enabled the MTR Corporation to develop areas next to the stations and thus promote increased MTR ridership level due to the proximity of these developments to the stations. Cervero and Murakami (2009:2022) point out that:

> Since land parcels near railway stations in dense, traffic-choked cities like Hong Kong are highly valued, the transit agency captures these benefits through land leases and sales to private interests.

An increase in ridership also ensures an increase in fare collection since the MTR Corporation is also responsible for MTR operations. Figure 6.1 depicts property developments alongside the Hong Kong MTR station. As explained by Verougstraete and Zeng (2014: 2) this Figure shows:

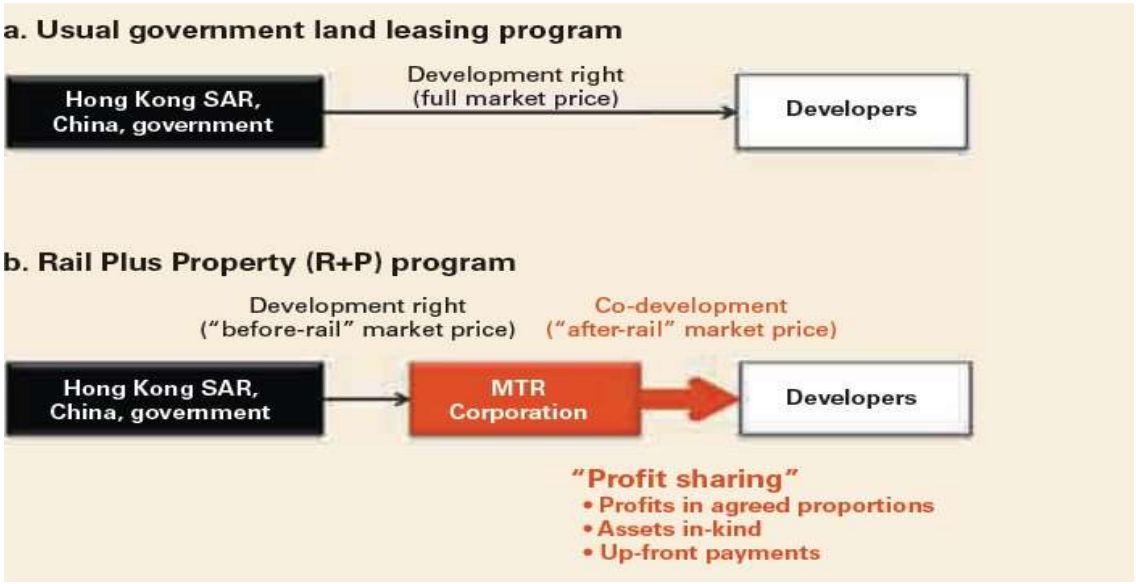
> ….the Hong-Kong Metro station where 415,900 sq.m. of fully integrated offices, retail and hotel facilities that were developed by MTR Corporation using joint property development programmes. This comprises notably the two International Finance Centre (IFC) towers.

**Figure 6.1: Photo of Property Development next to Hong Kong MTR Station**

Source: Verougstraete and Zeng (2014: 2)

Figure 6.2 shows the R + P property model as illustrated by Suzuki et al. (2015) from the adaptation of Cervero and Murakami (2009).

**Figure 6.2: R + P Property Mechanism in Hong Kong**




Source: Suzuki et al. (2015: 82)

Based on Figure 6.2, it is evident that the R + P Model has worked well for Hong Kong over the years as the MTR Corporation is able to derive profits from property developments. The profit sharing by the MTR Corporation and developers may be in agreed proportions, assets in kind or up-front payments, and depends on each case, as illustrated above.

Verougstraete and Zeng (2014: 2) give a detailed programme with regard to the property development programme in Hong Kong as shown in Table 6.1.

**Table 6.1: Property Development Programme in Hong Kong**

| Stage | Details |
|---|---|
| 1 | Assessment of construction costs by the MTR Corporation and government during the planning of a new railway line. This is followed by the preparation of a Master Plan for property development identification. |
| 2 | After obtaining approvals and negotiated terms, the MTR Corporation purchases development rights from government "for a period of 50 years" for property development "above railway stations and depots, as well as on land adjacent to the railway (referred to as "development rights")". |
| 3 | Tender document preparation by the MTR Corporation including allocation of development rights by dividing them into manageable lots for purchase by property developers. |
| 4 | Payment of all development costs by selected private developers such as "the land premium, for acquiring the exclusive development rights from the" MTR Corporation. The construction and commercialisation risks and other costs related to the residential and commercial properties are also borne by private developers. |
| 5 | This stage entails inclusion of "profit-sharing mechanisms in the agreements with the private developers. For the residential units", portion of profit generated received on sold units. Unsold units go back to the MTR Corporation for sale or leasing. For commercial units to be used as shops or offices, the MTR Corporation leases these units to developers or rents them out directly to generate rental income. |
| 6 | This is the last stage and consists of supervision of construction work, carrying out civil works and enforcement of "technical standards and requirements for interfacing between" the MTR Corporation "railway premises and the property development" are done by the MTR Corporation. |

Source: Verougstraete and Zeng (2014: 2)

Table 6.1 shows a detailed programme undertaken by the MTR Corporation and property developers to ensure that property development projects run smoothly. This kind of involvement enables the MTR Corporation to provide the support needed to ensure that projects undertaken are a success and the MTR Corporation benefits from profits accrued.

The above is further well-articulated by Suzuki et al. (2015:82) as follows:

> In the R+P model, MTR Corporation is the "master planner and designer" to align the interests of multiple stakeholders in different project phases. It prepares a development layout plan, resolves all interfaces with rail stations, takes care of tendering land parcels, acts as a liaison between the government and developers, monitors development quality and the sale of completed properties, and manages properties after completion.

Suzuki et al. (2015:76) also confirm that funding for public infrastructure and services in Hong Kong has been through revenue generated from the leasing of land, which accounts for about 20% of the income of the government of Hong Kong, and this has been coupled with heavy reliance of government on initial auctioning to capture increased land value. Sheng, Rong and Song (2011:1151) agree that the land support policy from the Hong Kong government has enabled the MTR Corporation to be known as "one of the few profitable companies in rail transit industry over the world". It is also interesting to note that the MTR Corporation has been so successful in running rail transit operations that it is even providing rail transit operating services in countries such as the United Kingdom (London), Sweden (Stockholm) and Australia (Sydney) (MTR Corporation, n.d.).

In a case study by Verougstraete and Zeng (2014: 3), it was indicated that the continuous dependence of the MTR Corporation on the revenues generated through real estate activities could be a challenge “if the real estate market were to decline”. Another point made by Verougstraete and Zeng (2014: 1) is that the MTR Corporation should not forget that its main objective or mandate is to provide rail transport services instead of property or real estate development, which has seen the MTR Corporation making huge profits over the years. These profits have been the ones that have supported various rail infrastructure projects implemented by the MTR Corporation.

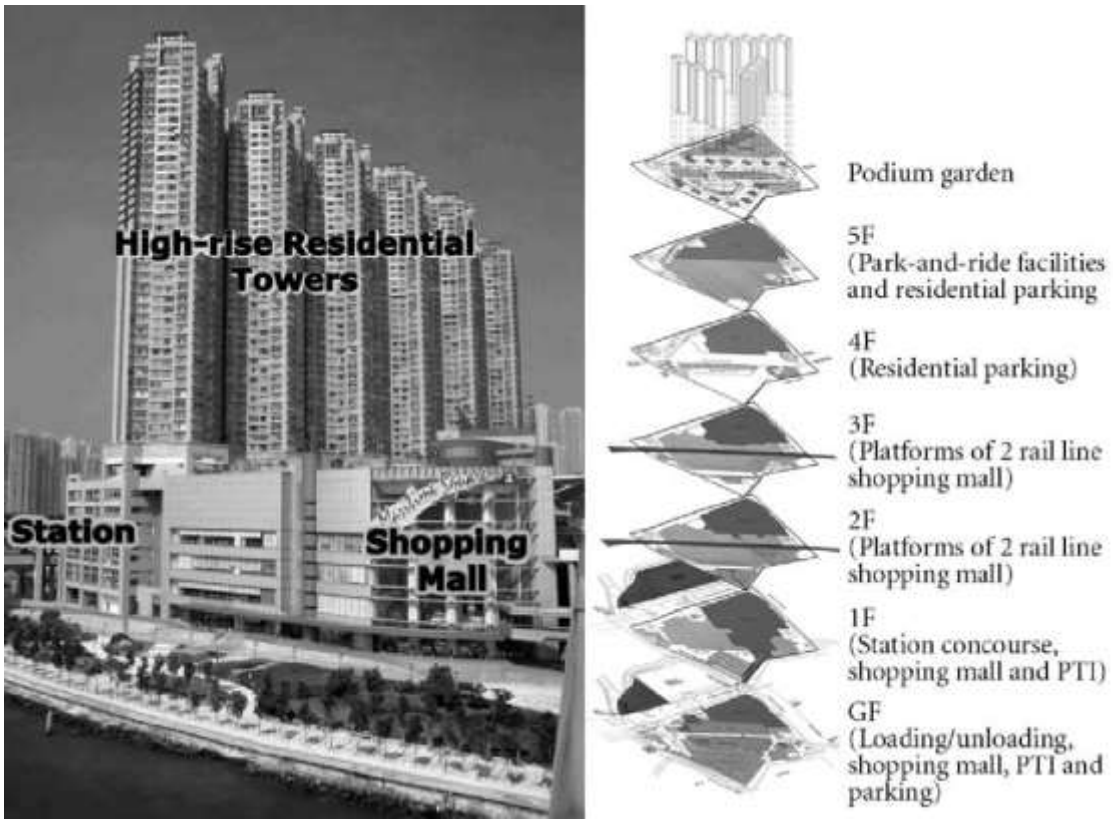
Even though land value capture is taken as the best funding mechanism, which has worked well for Hong Kong to fund railway projects, there may be risks associated with this mechanism such as a decline in property development and sales due to economic decline (Verougstraete and Zeng, 2014: 3)). These could result in declining profits, which may later have a negative impact on the implementation of rail projects and operations. Hong Kong may need to start treading carefully on this funding mechanism, especially during these times of unstable economic conditions across the world, with COVID-19 having had a negative impact on many private businesses including property development.

**Transit-Oriented Development**

Chow (2014:81) characterises Hong Kong as a city that is “fully transit-oriented developed”, with rail transport network being “the backbone of the city transport system” and supported by “franchised buses and mini buses”, which act as part of a feeder network system. The implementation of TOD in Hong Kong will be discussed by looking at R + P model of Maritime Square next to Tsing Yi station and the new town, Tseung Kwan O. As mentioned above, there are many R + P projects that have been implemented across Hong Kong, which have also led to TOD in those areas.

One of the projects implemented by the MTR Corporation is Maritime Square, which is part and parcel of the development of Tsing Yi station. The MTR Corporation bought 50-year development rights from government, which were later sold to property developers. With the profits made from this sale, the MTR Corporation was able to build the Tsing Yi station and some parts of the new Airport Express Line, and this development resulted in mixed-used development and integration between the railway station, shopping centre and residential buildings or towers since Hong Kong always build high-rise buildings due to land scarcity (Cervero & Murakami, 2009:2023). Housing units and different services are in one place in Maritime Square, with residential areas forming part of high-rise towers and the top floors of these towers making way for luxury apartments. People can stay and work within Maritime Square since everything including car parking and other modes of public transport such as buses and ferries are part of Maritime Square and located on different floors. The above is illustrated in Figure 6.3.

**Figure 6.3: Maritime Square residential-retail development on top of the Tsi Yeng station**

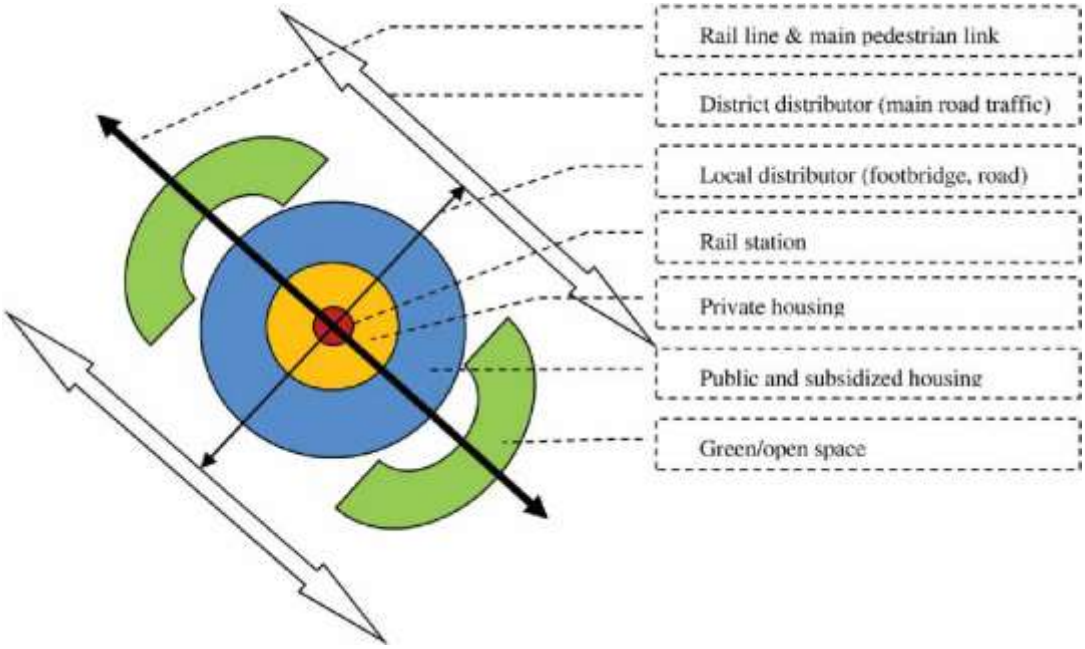



Source: Cervero and Murakami (2009: 2023)

Chow (2014:82) goes further to mention a new town called Tseung Kwan O, which has also embraced both urban and transport development by having this town supported by a rail network system and franchised buses. This town falls under New Territories, which is one of the four main areas of Hong Kong. Even though during the early stages of this town's development, transport demand was low, plans were made to accommodate the increase demand in transport since the town will be built in different phases with a target population in different development phases. Land has also been reserved to ensure future urban and transport development in this town along the concept of TOD (Chow, 2014:82). Tseung Kwan O is "divided into several transit-centred neighbourhoods, forming a cluster of transit-oriented development sites" (Chow, 2014:82).

It is evident that the property developers, including the MTR Corporation, want to continue the implementation of R+P projects while encouraging TOD in this town. Housing developments in this town are found closer to the rail network to ensure maximise use of the rail system. Since the MTR Corporation is the operator of the rail transport services, it must ensure that there are more than enough people to use the transport system to increase ridership and ensure profit maximisation as part of R + P model. The closeness of housing developments, both public and private, will ensure maximising the use of the rail network by residents of this town.

**Figure 6.4: Transit-Oriented Neighbourhood Plan of Tseung Kwan O**




Source: Chow (2014: 83)

Figure 6.4 shows how Tseung Kwan O has been planned as an R + P project and accommodates TOD elements by ensuring land use and transport integration. Private housing is situated next to the station, thus encouraging the R + P model in this town. Shopping malls are closer to the station. Public and subsidised housing is situated closer to the private houses but a bit farther away from the station. However, residents in these housing types can still walk to the station. Residents staying in the fringes can access the station by footbridge and road.

Chow (2014:84) noted that plans can only be made possible by the integration of land use and transport planning in this town. This, in a way, shows that successful implementation of TOD required both transport and land use disciplines to work together to achieve this kind of integration.

Based on these two cases, one can deduce that the R + P model, which has been used to finance rail transport operations by the MTR Corporation, can be used to promote TOD if all transport and land use planners are involved in projects of this nature.

### Land use patterns

Land use patterns in Hong Kong have been positively affected by the implementation of mass transit systems, with train stations being built to support the rail network system. The R + P model has enabled Hong Kong to continuously promote mixed-used developments near the rail stations. For example, in the Tsi Yeng station, the development of Maritime Square as a residential and retail development with car parking shows the positive impact of the rail station project in land use patterns. The same can be said with regard to the development of Tseung Kwan O town as outlined above.

### The impact on travel behaviour after project implementation

Research work on travel behaviour after the MTR project implementation was not found. The only information that was found was that on the impact of built environments on travel behaviour. This area of research seems to be important to try and understand how changes in the social and built environments affect the travel behaviour of people after the implementation of a particular transport project, in this case that is rail services.

The built environment refers to the type of housing development provided in a particular area. Wang and Lin (2013:288) discuss three different kinds of housing in Hong Kong, which are public rental housing mainly occupied by low-income families that cannot afford private housing renting, subsidised homeownership for low- and middle-income families, and private housing for high-income families. The size of the flats or units of the above-mentioned housings differs, with private housing having the largest size with the smallest number of houses in a block, while public rental houses normally are high-rise buildings with the smallest size per unit. Wang and Lin (2013:289) report that the size of flats in subsidised home ownership is in between public rental and private ones. Affordability is a determining factor in the cases above. Large size is equivalent to a high price for the purchase of a private house.

The social environment is attributed to how people in those neighbourhoods interact with each other. In most cases, those staying in public rental housing would probably use more social space outside their small flats compared to those in private housing who are likely to have spacious flats.

This background is relevant to the development of the Tseung Kwan O new town and how this town development under R + P model has impacted the travel behaviour of people living in this town. An investigation on travel behaviour and built environment was conducted using an extensive travel database, as noted by Chow (2014:84). This entailed the use of a 5Ds model (Density, Diversity, Design, Distance to transit and Destination accessibility) to discuss and analyse issues related to the built environment and travel behaviour in Tseung Kwan O. The analysis of travel behaviour and built environment based on the 5Ds model is found in Table 6.2.

**Table 6.2: Analysis of the 5Ds in Tseung Kwan O**

| Type of D | Summary of the analysis based on investigation conducted |
|---|---|
| **Density** | ● Increasing population accommodated in high-rise buildings of this town<br>● High-density development leading to stable supply of ridership, especially in the transit rail services<br>● Side effect of high-density development being urban functions, such as the mix of residential housing and landfill sites in the fringe development area of this town |
| **Diversity** | ● Compact and mixed land use (vertical and horizontal) of housing, government offices, shopping and schools but commercial or office land use lacking thus making this a commuter town<br>● Lengthy trips for work purposes likely to be reduced by having a good rail transit system<br>● Only 3% of walking trips in this town longer than 15 minutes compared to other town with higher % in terms of walking time |
| **Design** | ● Encircled pattern in terms of street design with major distributors bound each local neighbourhood, curvy street pattern and grid-like streets coexist in each neighbourhood<br>● Indirect access to ground level in mixed land use alleviated by having a pedestrian footbridge<br>● Walking behaviour confined to people's own neighbourhood, and no inter-neighbourhood interaction due to different street design features in this town e.g. curved and grid-like street as mentioned above |
| **Distance to transit** | ● Implementation of R+P project means that private housing is located closest to the station<br>● 34.5% of the population in private housing walk less than 250 m to reach the transit station while public housing is a bit further from the station with only 12.9% of people from public housing walking less than 250m to reach the transit station |
| **Destination Accessibility** | ● Good access to "schools, places of employment, retail shops and leisure centres"<br>● Commuting for work purposes is likely with average commuting time being 44 minutes and longest about 3 hours based on the investigation conducted<br>● High-income earners likely to commute for work purposes due to only 2% of jobs suitable for these workers being found locally compared to 23% of lowest-income jobs found locally |

Source: Chow (2014: 86-93)

Table 6.2 illustrates the travel behaviour of people in this town with the assistance of the 5Ds model. The above shows that the construction of the transit rail station and the development of this town have shaped and influenced the travel behaviour of the people living in this town.

## 6.6 The measures adopted to attract land use developments to desired locations and to discourage land use developments from undesirable locations

Hong Kong is one of the cities in Asia that has followed multiple intensive land use (MILU) concept loosely referred to as having intensive land use through a mix of residential, commercial and other uses at higher densities at selected urban locations and MILU is achievable with the support of an efficient public transport system and pedestrian network (Lau, Giridharan & Ganesan, 2005:527).

One of the measures used to attract land use development in Hong Kong has been the use of the R + P model to enable the MTR Corporation to develop new towns by building transit stations and high-density high-rise buildings outside Hong Kong. This has enabled this city to spread the growing population to new towns. Also, the government housing programmes accommodating low- and middle-income groups have also played a role in land use developments in these new towns where R + P projects have been implemented by encouraging new town development.

One of the measures adopted to discourage land use developments has been the sale of land rights by government mostly to the MTR Corporation and private property developers at a premium and approving a 50-year lease. Lau, Giridharan and Ganesan (2005:541) stated that government has the powers to make decisions on location and plot ratio, and because of this, it has been possible for government to prioritise economic spaces in selected locations. By having these controlling decisions, the government can discourage land use developments, for example, in cases where its objectives or priorities cannot be served.

## 6.7 Chapter conclusion

This chapter has provided detailed background information on planning and institutional arrangements, investment and operating arrangements, followed by discussing the impact of the MRT implementation on land value capture, TOD and land use after implementation of MTR in Hong Kong. From the above discussions, it became clear that Hong Kong has been successful in using its R + P model to fund the MTR project. However, it was difficult to find detailed information on travel behaviour after the MTR project implementation. Based on the discussions above, one can conclude that there have been positive impacts on land value capture, TOD and land use after the implementation of the MTR in Hong Kong.

# 7. SEOUL CASE STUDY

## 7.1 Introduction

This section gives a brief background on Seoul and then a discussion on planning and institutional arrangements before the implementation of the Bus Rapid Transit project. Seoul is the largest and capital city of South Korea, which forms part of Asia. South Korea is a neighbour of North Korea, and there are historical reports of strained political relationships between these two countries.

The history of Seoul dates back more than 600 years ago, when in 1894, it became the capital of the Chosun Dynasty. This was followed by a 10-year period of uncertainty since Seoul was at that time competing with another city for the status of being a capital city. The first service facilities and infrastructure were introduced in this city towards the end of the 19th century (Kim & Han, 2012:142).

## 7.2 The planning and institutional arrangements for public transport before project implementation: Seoul BRT

The colonisation of Korea by Japan between 1910 and 1945 came with different changes in its land system and resulted in many improvements in the transport, communication, electricity and land development systems of this country since Japan wanted Korea to take the lead in raw material supply and manufacturing of products (Kim & Han, 2012:143). This led to the introduction of a Chosun Civil Area Planning Enactment in 1934, which promoted urban expansion and establishment of residential areas outside Han Yang, as noted by Kim and Han (2012:143). Japan wanted to have a stronghold on Korea.

With the independence of Korea from Japan, Korea was left divided into two countries, North Korea and South Korea, with Seoul being part of South Korea. War between the two newly formed countries ruined Seoul's infrastructure, which had been built during the Japanese rule. According to Kim and Han (2012:143), it was only after 1953 that Seoul was rebuilt, and the government worked hard to protect the capital city from being completely ruined. This was a period where the government invested on highway infrastructure and light manufacturing industry to create much-needed jobs for the citizens of the country (Kim & Han, 2012:143).

The Urban Planning Act was endorsed in 1962 to replace the Chosun Civil Area Planning Enactment Act of 1934 to fast-track the establishment of the light manufacturing industry, which was more export-oriented and labour intensive; and the Land Expropriation Act was also enacted in the same year in 1962 to ensure that land was made available for building of these factories (Kim & Han, 2012:143). However, the prioritisation of the manufacturing industry led to unequal distribution of land, with housing competing with manufacturing for land use and eventually this had a negative impact on the price of houses in Seoul (Kim & Han, 2012:143).

Seoul, like Hong Kong, is also known as one of the most dense cities in the world. Kim and Han (2012:143) further explain that about 10 million people live in Seoul, which is

about 605km$^2$ in size and 237 km$^2$ out of the 605km$^2$ (39%) cannot be used for land purposes because of it being rivers and mountains.

Suburbanisation and urban sprawl in the Seoul Metropolitan Area between 1970 and 2003 increased the population within the region from 21 million in 1996 to 23.3 million in 2003 (Kim & Kwon, 2019:2). This also led to the increase in population in Seoul, which spilt to the surrounding areas. The increase in population, increase in private cars and industrialisation led to traffic congestion within Seoul and surrounding areas. This was also coupled with the reduction of good-quality bus services during the mid-1980s.

**What were the planning and institutional frameworks?**

As indicated above, Seoul has survived against all odds, dating back to the early 1900s to the early 1950s. With these political changes, Seoul introduced its first public bus services in 1953, which was the main mode of transport for over 40 years until the mid-1990s (Pucher, Park & Kim, 2005:44). Furthermore, bus usage was at its highest in Seoul between 1960s and 1980s and started experiencing a decline during the mid-1980s (Pucher, Park & Kim, 2005:44). This was due to various challenges experienced by Seoul such as increased congestion, which was caused by increased car usage and the introduction of metro rail services, and inefficient services provided by bus companies. In other words, buses had to compete with cars and metro services for market share (Pucher, Park & Kim, 2005:44). In the long run, the bus operators were also running at a loss and became bankrupt.

The role played by government with regard to the public transport system seemed to be very minimal in Seoul until the early 2000s. This is confirmed by Pucher, Park and Kim (2005:44) when they allude to the fact that:

> For decades, bus services in Seoul were operated by a large number of private firms, with virtually no government control of routes, schedules, or other aspects of service. Only the fares were determined by the Seoul Metropolitan Government, which also provided increasing operating subsidies to cover growing operating deficits that were causing many firms to go bankrupt or curtail the quality of their services.

Based on the above, one can conclude that private bus operators were left on their own without any kind of enforcement from government. This was a time when bus services were privatised with no regulation by government or another arm of government besides the setting of fares, provision of operating subsidies and construction and management of infrastructure by the Seoul Metropolitan Government. In other words, bus operators could choose where to operate (routes) and when (bus schedules) without any regulatory system from government.

The Seoul Metropolitan Government intervened in this situation when companies started going bankrupt and the level of services was at its lowest. The following interventions were implemented by the local government as outlined by Pucher, Park and Kim (2005:47).

- Bus operators were encouraged to consolidate their operations to reduce overhead costs and improve coordination, but this did not help the situation.
- Installation of curbside bus lanes was reported in 1984. These were dedicated bus lanes to speed up the bus travel in Seoul. However, bus ridership did not

increase as expected during this time, even after putting these measures in place.

- Government subsidy had to be increased from $9 million in 1999 to $110 million in 2002 to improve the quality of the service and keep the buses running. This was a huge increase, and it was not going to be affordable for government in the long run since local government was also expected to subsidise the metro rail services, which was reported to be very costly.

Based on the above interventions, some of which proved not to be successful, there was a need for public transport reforms or overhaul of the bus services in Seoul for the sake of both passengers and bus operators. The local government in Seoul needed to address this challenge and take control of the situation, which was uncontrollable and was posing safety challenges to the passengers or commuters (Pucher, Park & Kim, 2005:47).

The above events then forced the Seoul Metropolitan Government, under the political leadership of Mayor Myung-Bak Lee and the Seoul Development Institute (SDI), to research, develop and implement reforms in the public transport system (Pucher, Park & Kim, 2005:47). According to Kim and Kwon (2019:4), Mayor Lee had already advocated for public transport reform in Seoul during his mayoral campaign. Thus, this was one of the deliverables people were likely to expect from him after winning the mayoral campaign.

According to Pucher, Park and Kim (2005:47), SDI played a key role in conducting research work, which came up with recommendations on coordination and modernisation of metro and bus fares, payment systems, integration of both services (metro and bus), expansion of dedicated bus lanes and the overhaul of the organisation and operation of bus services in Seoul.

**How did these frameworks facilitate the implementation of the project?**

After the decision had been made to reform the public transport system in Seoul based on recommendations from the SDI, the mayor's office undertook extensive stakeholder engagements to explain the need for public reforms and their benefits. It should be noted that in the beginning, the BRT reforms were strongly opposed by the bus operators' union (Matsumoto, 2007:364). This then led to the establishment of the Bus System Reform Citizen Committee (BSRCC), which consisted of 20 representatives from the Seoul Metropolitan Government, Seoul Metropolitan Police Agency, the bus industry, citizen groups and professionals (Matsumoto, 2007:364). This was an independent committee established by the mayor of Seoul, with the hope that this committee would assist in reaching consensus with regard to the implementation of the proposed bus reforms. The establishment of BSRCC paved the way forward as all stakeholders were informed about the proposed plans and involved in decision-making.

The office of the mayor regarded the media as the mouthpiece of these reforms to get through all stakeholders including motorists and transit riders. This is supported by Pucher, Park and Kim (2005:48), who reported that the media campaign was used as a platform to convince the citizens of this new plan based on the research and

recommendations that had been done. It was important to get buy-in from all stakeholders before the start of the implementation of the public transport reforms.

Mayor Myung-Bak Lee started the implementation of the improvements in the public transport services after two years in office on 1 July 2004 (Pucher, Park & Kim, 2005:49), and the following reforms were implemented:

- Government took more control of the bus services by playing a role in the allocation of bus routes, schedules and fares.
- Bus operators were paid based on vehicle kilometres travelled instead of passenger trips.
- The route network was redesigned to ensure the integration of 400 bus routes. This led to colour coding of buses into four types as illustrated in Figure 7.1.
- The colour coding of these buses is also confirmed by Cervero and Kang (2011:104). A Bus Management System (BMS) was also set up to ensure coordination of bus services in Seoul.
- Global Positioning System (GPS) terminals are in every bus. This enables monitoring of all bus locations and speeds by the central bus control centre, communication with drivers, adjustment of number of buses per route and also provision of real-time information for passengers.
- Expansion and upgrading of dedicated lanes for buses were implemented. The curbside increased from 291 km to 294 km. This led to the development of a BRT network with dedicated median lanes, highly quality median stops and real-time information for passengers and BRT operators as alluded to by Cervero and Kang (2011:102).

**Figure 7.1: Colour-coded BRT buses in Seoul**

| Colour Code | Description |
|---|---|
| Blue bus | Long-distance express bus connecting outlying suburbs with each other and city centre |
| Red bus | Long-distance express bus connecting new cities with city centre |
| Green bus | Provides local services throughout the metropolitan area and feeding metro stations and express bus stops |
| Yellow bus | Provides local services within city centre |

Source: Pucher, Park and Kim (2005)

The colour coding in Figure 7.1 was implemented for ease of riding by commuters since they knew the meaning of all the above colour coding. Even though it was not easy for commuters to distinguish the colour codes of different routes, this improved with time.

Cervero and Kang (2011) also mention the introduction of median lanes in mid-2004. Lee, Lee and Lee (2006:199) confirm that the median lane provides a more exclusive right of way to buses.

According to Pucher, Park and Kim (2005:49), the government's commitment to the BRT implementation resulted in the addition of 62 km of BRT over seven more corridors by 2006.

Kim and Han (2011:147) reported that the public transport reforms in Seoul included the integration of the bus system with the subway (rail service) and the development of the new airport known as the Incheon International Airport to address the demands of increasing international travel volume, which could not be accommodated at an old airport, Gimpo airport.

The implementation of bus services was planned for a number of years, and it involved government, operators and full support from commuters.

## 7.3 The nature of the transport investment

The nature of the transport investment will be discussed below under project sponsor, structure of the investment and loan payment arrangements.

### Who was the project sponsor?

Based on the above, it is clear that the project sponsor for the implementation of BRT services was mainly the Seoul Metropolitan Government. As mentioned above, government expanded and upgraded the dedicated lanes including the curbside. In other words, the Seoul Metropolitan Government was responsible for the payment of all infrastructure related to the bus reforms in Seoul.

### How is the investment structured?

The bus reforms in Seoul were mainly funded by the Seoul Metropolitan Government. It was reported that "the most costly item was the subsidy promised to the bus companies on condition that they agreed to the quasi-public bus operation and management system" (Kim & Kwon, 2019:15). Furthermore, Kim and Kwon (2019:15) reported that the subsidies paid to the bus operators were to be:

> ….about W80 billion for the second half of 2004 alone, but it had to gradually increase the subsidy amount up to W 300 billion per year. As bus companies' operating deficits grew rapidly, so did the subsidy amounts. The total amount of subsidy was W 210 billion for the second half of 2004, and it grew to W 320 billion in 2007. It rose as high as W 550 billion in 2007. It decreased to W 500 billion in 2012, but it is still large and quite a burden on the city.

The quasi-public bus operation means that the Seoul Metropolitan Government is involved in the operations of the systems since it is the one that is responsible for many

aspects of operations such as allocation of routes, schedules and fares, while the bus operators provide the required bus services based on information received from Seoul Metropolitan Government (Kim & Kwon, 2019:3). The subsidies are in a way a driving force for the bus operators to continue providing the services to the commuters as there is always a guarantee that the bus operators will be fully reimbursed for any losses made (Kim & Kwon, 2019:15).

**Are there any loan payment arrangements?**

Since the Seoul Metropolitan Government was responsible for funding the reforms, there were no loan payment arrangements.

## 7.4 The operational arrangements of the system

The operational arrangements will be dealt with in two folds, which are operator of the system and roles and responsibilities of the operator.

**Who is the operator of the system?**

Since the quasi-public bus operation and management system exists in the Seoul BRT, the operator of the BRT system is both the Seoul Metropolitan Government and the private bus operators. These operational arrangements became effective after the bus reforms that took place in 2004, wherein government took a leading role with regard to the provision of BRT services in Seoul.

**What are the roles and responsibilities of the operator?**

As mentioned above, the Seoul Metropolitan Government took more control of the bus services by playing a role in the allocation of bus routes, schedules and fares. In other words, it was responsible for day-to-day operational services to ensure that efficient bus services were provided by bus operators. Based on the above, it is assumed that bus operators were then responsible for providing day-to-day services as per the allocated bus routes and schedules received from the Seoul Metropolitan Government

## 7.5 The impact of the implementation of the system

**Land value capture**

Limited information was found on land value capture in Seoul. Cervero and Kang (2011:115) concluded that land price premiums in the 5–10% range were estimated for residences within 300m of BRT stops. In the case of retail shops and other non-residential use, land premiums increase between 3% and 26% were recorded for facilities within 150m from the BRT stops as alluded by Cervero and Kang (2011:115). The same conclusion was also drawn by Jun (2012:89), wherein it was found that land values in zones that were closer to the BRT increased while a decrease in land values was experienced in the outer ring zones. This was specifically related to the housing demand. However, the rental impact after the implementation of BRT was reported to be minor in Seoul.

## Transit-Oriented Development

This section discusses issues related to the impact of TOD after the introduction of BRT in Seoul, South Korea. Sung and Oh (2011:70) acknowledged TOD as playing a role in solving traffic congestion in Seoul by ensuring that high-density developments are built in and around Seoul. However, the point to take into consideration here is that Seoul is already a compact city, and the issues of TOD would have to be considered carefully in this case.

The then-mayor of Seoul, Mayor Lee, supported TOD (Cervero & Kang, 2011:105). This led to the implementation of various projects in support of TOD in Seoul during the public transport reforms, which started in 2004. Some of these developments are discussed below.

Land reclamation was implemented by converting space that had been used for cars to parks. One of these projects was the removal of a 6km freeway, Cheonggye, in Seoul and turning it into an urban stream and pedestrian-friendly greenway, as reported by Cervero and Kang (2011:105). Figure 7.2 shows the before and after look of Cheonggye after the restorations.

**Figure 7.2: Before and after restoration of Cheonggye in 2005**

**Before restoration** **After restoration**

Source: Kim and Han (2012:152)

According to Kim and Han (2012:152), the restoration in Figure 7.4 resulted in the creation of a new street with riverside features, new office space and commercial buildings. Another noticeable development in Seoul was the conversion of a 1.3 ha surface-street intersection in front of Seoul's City Hall to an oval-shaped grass park (Kim & Han, 2011:152), as shown in Figure 7.3.

**Figure 7.3: Seoul City Hall**

Source: Surtel (2019) [5 August 2024] CC-BY-SA-4.0

Besides the developments discussed above, the Seoul Metropolitan Government worked hard to provide various amenities such as green space and expansion of infrastructure services and ensured that most of these developments were built next to the median-lane BRT corridors (Cervero & Kang, 2011:105). This would enable people living and/or working in those new developments to have easy access to the BRT.

### Land use patterns

Empirical studies have been conducted on land use impacts after transit development in various cities across the globe. Some of these studies have argued that the most positive impact on land use patterns has been more on light rail transit development rather than BRT development and this view is also supported by Cervero and Kang (2011:103) who note that:

> Most studies of public transit's impacts on cities and land values have focused on heavy rail systems since such capital-intensive investments have historically conferred the most significant accessibility benefits of any transit improvements.

These opinions have been raised by various researchers, with some pointing out that the nature of the transit system, the degree of accessibility, economic conditions, existing land use patterns in the area and public sector involvement are key factors in determining the effects of transit development (rail or bus) on land use patterns (Jun, 2012:86).

In the case of Seoul, one needs to take into consideration that this city is one of the densest cities in the world. Housing in Seoul has always been a challenge due to rapid urbanisation and various competing needs for space. Government in Seoul tried solving this problem by constructing high-rise apartments as early as 1962, which constitute the largest type of housing in Seoul. This has been mostly common in urban redevelopment projects, as noted by Kim and Han (2011:146). The mid-1980s to late 2000s saw an increase in housing prices, with apartment prices becoming very high and unaffordable for many citizens of Seoul (Kim & Han, 2011:149). In general, it became unaffordable for people to buy houses during that period including apartments,

which are expensive compared to other housing types in Seoul since they are mostly of good quality (Kim & Han, 2011:146).

As a result of all this, the Seoul government at national and local levels took a decision to develop satellite towns to deal with the housing shortage problem and increased property prices in Seoul, and the newly developed towns are Bundang, Ilsan, Sanbon, Pyongcheon, and Joongdong (Kim & Han, 2011:146). Furthermore, various policies were used to address high property prices, as reported by Kim and Han (2011:146).

These land use patterns happened after the public transport reforms and the introduction of median lanes for BRT buses in Seoul, but they were mainly because of the need to address national economic problems, which happened after public transport reforms.

In a study by Cervero and Kang (2011:105), multilevel binary logit models were used to determine the impact of BRT development on land use. This entailed making predictions on three types of conversions from single-family residences to multi-family residential rental units, to condominium owner-occupied units, and to mixed parcels involving a combination of commercial activities and sometimes residential space (Cervero & Kang, 2011:105). The methodology of this research study entailed tracking land use statuses of more than 52,000 single-family houses during a six-year period from 2001 to 2007 (Cervero & Kang, 2011:108). The findings of this research study were that more than 96% of those single-family houses continued being single houses, and with the remaining houses being converted to multi-family houses, mixed land uses, and condominiums (Cervero & Kang, 2011:108).

Furthermore, the above conversion was possible for houses that were less than half a kilometre from the BRT stop compared to those more than half a kilometre. Condominiums and mixed-used developments were highly unlikely to be situated less than 100m from the BRT bus stop due to factors such as noise levels, which could not be avoided (Cervero & Kang, 2011:109).

Based on this study mentioned above, one can conclude that the land use patterns in this study area were not positively impacted by the BRT project since only 4% of the single houses were converted to multi-family houses, mixed land uses, and condominiums.

**The impact on travel behaviour after project implementation**

Various changes related to quality were reported in Seoul six months after the implementation of the BRT services. According to Cervero and Kang (2011:104), there was an increase in the bus speed (doubling the speed from 11 km/h to 22km/h) due to buses using dedicated medial lanes, but there was a reduction in the number of accidents and travel time and an increase in passenger satisfaction. Jun (2012:85) noted that the dedicated median-lane BRT services that were introduced in Seoul in 2004 are considered to have paved the way to reduce car usage and increase the speed of bus services, thus increasing ridership.

As a result of these changes, people were convinced of the improved quality of bus services, and this increased the patronage level to about 10% between the end of 2003 and the end of 2004 (Cervero & Kang, 2011:104). Furthermore, it was reported that daily patronage for bus services was 100,000 more than that for subway (Cervero & Kang, 2011:104).

A study was conducted by Kim, Lee, Gin and Sol (2021:136) on BRT user behaviour after the implementation of the Jongno BRT project. The study area in this research study was a 2.8 km section of Jongno, one of the districts falling under Seoul, which consists of streets known for cultural, industrial and historic sites and commercial areas. This includes cultural heritage sites such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) and Jongmyo Shrine.

Data was collected from blog posts of BRT users of 1st to 6th Streets of Jongno and sought to identify different places visited by users along these Jongno streets by searching keywords used. Kim, Lee, Gin and Son (2021:144) reported that changes in user behaviour were found after the BRT implementation and a few of these are mentioned below:

- With regard to places located within a 500m radius of the BRT station, the frequency of place keywords increased in the categories of historic sites, and commercial and business facilities.
- There was a decrease in the frequency of place keywords in other categories, and this was the opposite of what had been found in earlier studies.
- In places located outside the 500m radius of the BRT station, there was an increase in keyword frequency under open spaces, cultural and religious places, and these places could be reached by walking from the BRT station.
- There was also an increase in keyword frequency falling under business and commercial facilities as it became easy for BRT users to reach those places using BRT. Some users mentioned ease of access to shops when using BRT compared to when using metro services. An added advantage was the enjoyment of beautiful views while riding on the BRT bus.

The following conclusions were made:

- With the use of BRT, people were encouraged to walk to their destinations after disembarking from the BRT bus and this could transform Seoul into a walking city as concluded in this study by Kim, Lee, Gin and Son (2021:144).
- There is a need to analyse BRT projects from the planning phase to the connecting phase to understand the behavioural changes of users during the whole period, as concluded by Kim, Lee, Gil and Son (2021:145).
- Integration of BRT with other modes of transport could lead to convenience, management of sustainable urban space and improvement in the quality of lives of users, as outlined above by Kim, Lee, Gil and Son (2021:145).

The study area for this research was a busy street due to various commercial, business, and public facilities on this street, as mentioned above. Therefore, Kim, Lee, Gil and Son (2021:145) recommended that in future, a research study on user behaviours be conducted on BRT implementation in suburbs and residential areas to

understand the impact of BRT implementation on road users and facilities provided in these areas.

## 7.6 The measures adopted to attract land use developments to desired locations and to discourage land use developments from undesirable locations

Land use developments to desired locations were attracted through various policies that were introduced by the government as mentioned above under the land use patterns section and reported by Kim and Han (2012:146). Kim and Han (2012:146) explained that this was due to challenges experienced with the housing shortage and high property prices in Seoul, which prompted government at national and local levels to develop satellite towns in Bundang, Ilsan, Sanbon, Pyongcheon, and Joongdong. It should be noted that these developments also happened during the time of bus reforms in Seoul.

The government has invested in public rental housing for people who cannot afford to buy their own houses or rent apartments in Seoul. In the past, these rental houses were built on the outskirts of this city for low-income earners. As a result, these people had to travel long distances to reach their jobs and access social services. To address this problem, Seoul Metropolitan Government produced an inclusionary zoning policy, which is directly linked to new residential redevelopment projects and Shift, a long-term rental housing programme. The inclusionary zoning policy advocates for access to affordable housing for low-income earners in places that are in proximity to work by ensuring that 17 to 20% of houses built by developers fall under social housing (Kim & Han, 2012:146). Social inclusion is the only way that will enable this group of income earners to live closer to their work.

According to Kim and Han (2012:146), Shift was still in its early stages, but the plan was to lease apartments for a period of 10 years with the possibility of extending the lease to 20 years. These apartments would also be leased at a lower price compared to the price charged to leasing private apartments, thus increasing the affordability of renting apartments.

In a way, various taxes were also used to discourage land use development. According to Kim and Han (2012:146), another strategy that was used by government was to levy development fees to land developers. Owning an expensive house in Seoul attracted a special tax in the 1990s. Even though the above taxes could be seen as discouraging land use development, the writer is of the view this would be more applicable to people who were struggling to afford buying these properties but for rich people or high-income earners it would not be the case. These interventions were, in a way, discouraging people from owning properties within the city.

The Seoul government used urbanisation and decentralisation policy to move people away from the city to neighbouring towns to reduce the population in Seoul, which had grown from 1.6 million in 1955 to 10.6 million in 1990 (Kim & Han, 2012:146). As a result of decentralisation, Seoul's population was reduced slightly below 10 million from 1990 to 2005 (Kim & Han, 2012:146).

## 7.7 Chapter conclusion

This chapter has discussed BRT implementation in Seoul especially after the public transport reforms that took place in 2004. This was done by first looking at planning and institutional arrangements before the BRT implementation under bus reforms, followed by the impact of this project implementation on land value capture, TOD, land use patterns and travel behaviour.

A positive impact was noted in Seoul on TOD after the implementation of the BRT in 2004, as highlighted above. However, there was limited information available on land value capture and land use patterns after the implementation of the Seoul BRT.

# 8. SIMILARITIES, DIFFERENCES AND LESSONS LEARNT FROM CASE STUDIES

## 8.1 Introduction

The last four chapters (Chapter 4 to Chapter 7) have been on data collection as per the Research Methodology that was outlined in Chapter 3 and in line with research questions that were crafted and presented in Chapter 1.

With the collected information, this section of the study seeks to analyse the collected information and attempts to identify similarities and differences between different themes of the data collected and come up with lessons learnt from these case studies and how these lessons can be applied in the South African context regarding bus rapid and rail transit systems developments and implementations. This chapter is in line with the discussion on data analysis provided in Chapter 3 of this research study.

## 8.2 Synthesising matrix for Copenhagen, Curitiba, Hong Kong and Seoul case studies

A synthesising matrix for the four case studies that have been discussed from Chapters 4 to 7 is provided in Table 8.1.

**Table 8.1: Synthesising Matrix for Copenhagen, Curitiba, Hong Kong and Seoul**

| Theme | Copenhagen (Copenhagen Metro) | Curitiba (BRT) | Hong Kong (Mass Transit Rail) | Seoul (BRT) |
|---|---|---|---|---|
| **Planning and institutional arrangements before project implementation** | • Finger Plan publication in 1940s<br>• City being administrative and cultural area (palm of the hand)<br>• Towns developing along radials (fingers)<br>• Green wedges/areas between fingers with no building or construction allowed<br>• Establishment of retail, banking and educational facilities in new towns<br>• Regional train network and roads<br>• Planning under Great Copenhagen Council from early 1970s<br>• Challenges experienced in the Council due to different political regimes<br>• Abolition of Council leading to central government responsible for planning with new projects e.g. Metro | • Agache Plan between 1941 and 1943 promoting radial road system from downtown<br>• Agache Plan implemented till 1960s<br>• Revised Agache Plan became Master Plan launched in 1966 by City Council<br>• Proposed changes in the radial system by having transit-based axes to direct linear growth of the city<br>• Inclusion of land use transport planning in the Master Plan with mixed-used development along main transport corridors<br>• IPPUC located in mayor's office and unfairness realised due to politics of the day leading to benefits by people close to the political administration<br>• City planning influenced by mayor's office<br>• Projects from 1971 to 1983 included changes on zoning and | • Planning matters responsibility of Planning Department<br>• Development of Standards and Guidelines to facilitate social & economic development<br>• City undergoing huge renewal & development in 1980s and 1990s<br>• Implementation of mega projects including Mass Transit Rail<br>• Town Planning Board responsible for introduction of development comprehensive areas | • Minimal role played by government in public transport system till early 2000s<br>• Government providing subsidies to private operators<br>• Privatised bus services with no regulation<br>• Continuous poor bus services and need for government intervention, with bankruptcy reported in some bus operators<br>• Public transport reforms led from Mayor's office – SDI providing research development as part of technical support<br>• Establishment of BSRCC to spearhead BRT Reforms (members from government, bus industry, citizen groups & professionals) |

| Theme | Copenhagen (Copenhagen Metro) | Curitiba (BRT) | Hong Kong (Mass Transit Rail) | Seoul (BRT) |
|---|---|---|---|---|
| | Development, Ørestad New Town, Road and Rail links<br>● Copenhagen Metro – a driverless, 24/7 rail transit starts Phase 1 operations in 1994 with M1 and M2 lines<br>● M3 and M4 lines follow later | land use legislation, transport planning prioritisation<br>● Political part changes disrupted some good plans in the mid-1980s<br>● BRT implementation from 1974 by a multidisciplinary team of architects, engineers, geographers, sociologists<br>● Continuous major improvements and transformations<br>● Full BRT system realised with tube stations, single flat fare and exclusive lanes | | ● Key role played by government after BRT reforms |
| **Transport investment: project sponsor, structure of investment and loan payments** | ● Project sponsor being Ørestad Development Corporation (joint ownership by Copenhagen municipality and Danish state)<br>● Land allocation responsibility of national government<br>● Land rezoning responsibility of local government<br>● Ørestad Development Corporation received funding for construction through public loans with no direct finding from local or national government<br>● City & Port took over in 2007<br>● Loan payments through value added by selling land next to the developments-money collected from sales used for loan payments | ● Government-Project sponsor for Phase 1<br>● Other phases funded by loans and government<br>● Development banks such as IDB and AFD provided funding at later stages | ● Project sponsor is Mass Transit Rail Corporation (MTR Corporation)-initially publicly owned company but now 23% of shares owned by private investor<br>● MTR Corporation having exclusive development rights for land above and adjacent to stations<br>● Rail projects financed through profits made from land sales (LVC across Hong Kong)<br>● MTR Corporation also involved in transport operations, station commercial businesses and property rental management | ● Project sponsor: Seoul Metropolitan Government<br>● No loan payment arrangements – government responsible for funding reforms |
| **Operational arrangements: operator and roles and responsibilities** | ● Metro Services A/S operator of the metro (joint venture between ATM and Hitachi Rail Services)<br>● Operator responsible for operations by ensuring service stability, quick decision making, ensuring safety of passengers at all times<br>● Operators responsible for maintenance by ensuring effective execution of planned maintenance, reliable management of | ● Outsourcing of operations and appointment made by URBS<br>● Currently 11 operators<br>● Operators responsible for operations as per service orders, maintenance, hiring and remuneration of personnel | ● MTR Corporation responsible for operations of the rail network of 9 railway lines<br>● MTR Corporation also responsible for operations of high-speed rail and intercity railway services | ● Private bus operators responsible for daily bus operations<br>● SMG responsible for allocation of bus routes, schedules, and fares |

| Theme | Copenhagen (Copenhagen Metro) | Curitiba (BRT) | Hong Kong (Mass Transit Rail) | Seoul (BRT) |
|---|---|---|---|---|
| | interfaces, and ongoing process optimisation | | | |
| **Impact of project implementation on land value capture, TOD and land use patterns (incl. travel behaviour)** | • Land value capture used to finance new projects<br>• City & Port being a public-private company able to make own decisions without interference from government<br>• Large projects implementation (rezoning and infrastructure investments) and LVC used to fund these projects<br>• City & Port able to borrow from the market at favourable terms<br>• TOD found in new towns developments<br>• Ørestad New Town one of the developments with Copenhagen metro station forming the backbone of public transport<br>• Relocations of companies found in Copenhagen to this new town and close to the Copenhagen Metro Station in Ørestad<br>• Commuting of workers from Sweden to Ørestad by metro, and private cars<br>• Land use patterns in new towns e.g. Ørestad with following division: 60% for offices, 20% for houses and 20% for facilities<br>• Metro station development in Ørestad facilitated land sales for above uses, leading to mixed-used development around Ørestad station | • Increased in land value along the corridors and revenue used for development of industrial sites<br>• Later plans to use above revenue to fund Green Line project (BRT)<br>• Land values next to corridors more expensive than those further away from corridors<br>• TOD: Master Plan of 1966 promoted growth along linear axes with high population density & mass public transport along the axis<br>• Medium and large developments built along transit corridors<br>• Transit corridors with highest concentration of people, various services and facilities<br>• Land use patterns: public facilities and housing found along transport corridors<br>• Five-spoke irregular shape of Curitiba<br>• Ease of transfer between buses using single fare system, making public transport affordable and reducing transport costs | • Land value capture: application of Rail + Property Model by developing land and using the profits for construction of rail infrastructure and operations<br>• Well-developed R & P model making profits over the years<br>• LVC: best funding mechanism<br>• Hong Kong MTR station with integrated offices, retail & hotel facilities<br>• Concerns over MTR Corporation also concentrating on other businesses besides provision of rail services for MTR<br>• TOD: case studies reported under R & P model, e.g. Tsi Yeng station with mixed-used land development-shopping centre and residential areas next to the MTR station<br>• Tseung Kwon O town also having elements of TOD<br>• Land used patterns: positive impact as witnessed in Tsi Yeng station and Maritime Square<br>• Travel behaviour in towns such as Tseung Kwan O studied after development of the town<br>• Use of 5D model to analyse above study on travel behaviour | • Land price premiums increase for residences within 300m to BRT stops<br>• Decrease in land values in outer ring zones<br>• TOD: conversion of parking space to park, street intersection to grass park, removal of freeway and building of office space and commercial buildings<br>• Provision of more green space and expansion of infrastructure next to median lanes BRT corridors<br>• Land use patterns: building of high-rise apartments<br>• Conversion of about 4% of single storeyed houses to multilevel houses, condominiums & mixed land uses next to the BRT corridors<br>• Increase in patronage level to 10% between end of 2003 & end of 2004<br>• Increase in daily passengers using BRT reported<br>• Increase in frequency of places visited within 500m from BRT stations<br>• Transformation of Seoul into a walking city |
| **Measures adopted to attract land use developments to desired locations and discourage land** | • Attract: sales of land for mixed land used developments next to metro stations<br>• Discourage: protection of green wedges from any kind of development over the | • Land zoning for high-density housing within two blocks of the transit arteries, allowing close proximity to BRT, thus attracting land use development | • R & P Model used to attract land use development leading to development of new towns by building transit stations and high-density high-rise buildings outside Hong Kong | • Construction of affordable housing in newly developed towns-use of various policies<br>• Inclusionary zoning policy developed to |

| Theme | Copenhagen (Copenhagen Metro) | Curitiba (BRT) | Hong Kong (Mass Transit Rail) | Seoul (BRT) |
|---|---|---|---|---|
| **use developments from undesirable locations** | years through continuous reference to Finger Plan when making development and or expansion decisions and providing guidance to new developers and planners on protection of green areas | • Limited parking space to discourage motorists in the city centre<br>• Linear development encouraged along the BRT corridors to discourage people from travelling to downtown area and heavy commuting realised along the transit arteries | • Sale of land rights by government at high premium to land developers has discouraged land use development from undesirable locations | build social houses in close proximity to work<br>• Special tax imposed to owners of big houses & levying of development fees to land developers used to somehow discourage land use development next to the city<br>• Use of urbanisation and decentralisation policies to move people away from the city to neighbouring towns and reducing Seoul population |

## 8.3 Similarities and differences and lessons learnt

The similarities and differences and lessons learnt are discussed in this section.

### 8.3.1 Similarities found in the four case studies

This section provides similarities found in the four case studies as highlighted in the synthesising matrix in Table 8.1.

#### 1. Planning and institutional arrangements before project implementation

The similarities found in the case studies are that Copenhagen, Curitiba, and Seoul's transit systems were heavily influenced by the political involvement of mayors and/or senior political leaders within these cities, thus facilitating the implementation of the projects. If it had not been for their involvement, it would have taken longer to get buy-in from different stakeholders such as members of the public, businesses, and private organisations.

It is also noted that Copenhagen and Curitiba had distinctive plans known as the Finger Plan and Master Plan, respectively, which heavily influenced the location of their respective transit projects. The Copenhagen Metro stations were developed along the radials (towns) and BRT stations in Curitiba were located next to towns, forming linear growth.

#### 2. Transport investment in terms of project sponsor, structure of investment and loan payments

The first phases of all four projects were sponsored by their respective governments since government had a vested interest with regard to the implementation of these projects to address their respective urban transport problems and the development of their respective cities.

3. **Operational arrangements in terms of operator and roles and responsibilities**

Curitiba and Seoul case studies are on BRT projects, and their service operations are provided by more than one bus operator. The Copenhagen Metro and Hong Kong MTR are mass transit rail projects, and their service operations are provided by one operator, which is Metro Services A/S and the MTR Corporation, respectively.

4. **Impact of project implementation on land value capture, TOD and land use patterns (incl. travel behaviour)**

A positive impact was derived from land value capture after project implementation in Copenhagen, Curitiba, and Hong Kong, with revenue generated used to develop future phases of these projects. With regard to the impact of BRT project implementation in Seoul, not much information was found besides the fact that the 5–10% range was estimated for residences within 300m of BRT stops.

TOD was positively affected after project implementation in all four cities, as illustrated in Chapters 4 to 6. New towns were built and supported by the developments of these projects. These new towns were built closer to the stations to encourage TOD.

The impact of land use patterns after project implementation was also positive. This resulted in mixed-used developments in the four cities. Developments were made according to land use patterns of respective cities and towns.

The implementation of the BRT and rail transit systems had a positive impact on the travel behaviour of these cities including new towns that we developed. In Seoul, this resulted in Seoul becoming a walking city as it became easier for people to access various services and facilities that were located closer to BRT stations. Also, ridership and patronage levels increased after the implementation of these projects due to improvements in the quality of the services.

5. **Measures adopted to attract land use developments to desired locations and discourage land use developments from undesirable locations**

Attracting land use developments has been a norm in all the cities, but it is in line with the developmental rights or plans of the respective cities. Mixed-use developments have been encouraged in the four cities, resulting in developments that are closer to either BRT or rail transit stations.

### 8.3.2 Differences found in the four case studies

This section provides differences found in the four case studies as highlighted in the synthesising matrix in Figure 8.1.

1. **Planning and institutional arrangements before project implementation**

Literature on political involvement in Hong Kong seemed to be lacking during data collection even though there was and still is strong political involvement in the MTR projects developments as they are at the forefront of making decisions on MTR developments.

2. **Transport investment in terms of project sponsor, structure of investment and loan payments**

Later phases of these projects in different cities were funded in various ways. For example, the Seoul government continued funding other phases of this project. There is no detailed information as to how these funds were sourced. Copenhagen and Hong Kong's projects were funded through revenue made from land value capture. Copenhagen relied on public loans, which were paid through land sales facilitated by City & Port. In Hong Kong, future phases were funded from revenue made from land value capture by the MTR Corporation. In the case of Curitiba, later phases were funded by loan borrowings made by government.

3. **Operational arrangements in terms of operator and roles and responsibilities**

Operations are completely outsourced in Copenhagen, Curitiba and Hong Kong. In Hong Kong, the MTR Corporation is partly owned by the Hong Kong government, but functions independently and thus has some elements of functioning like a public-private company as there is no interference from government.

Another difference that was found in the two BRT case studies is that Seoul's bus operators are only responsible for the provision of services while the schedules, routes and fares are still the responsibility of the Seoul Metropolitan Government, whereas in Curitiba, bus operators are fully responsible for all bus operations.

4. **Impact of project implementation on land value capture, TOD and land use patterns (incl. travel behaviour)**

One would expect differences with regard to land value capture, TOD and land use patterns in these four cities in terms of the approach since the cities are from different countries with different policies and ideologies.

In cities such as Hong Kong and Copenhagen, heavy reliance on land value capture was realised to finance their respective projects from the beginning, and this was done from the first phases of these projects, whereas Curitiba and Seoul land value capture was allowed to grow steadily after implementation of Phase 1. Curitiba realised the benefits of land value capture and was able to use the revenue to develop industrial sites and, later, BRT lines such as the Green Line Project in Curitiba.

5. **Measures adopted to attract land use developments to desired locations and discourage land use developments from undesirable locations**

With regard to discouraging land use developments from undesirable locations, all Copenhagen and Seoul cities have used their respective Plan and policies respectively to implement these measures, while Curitiba and Hong Kong have relied on land sales and rights to implement these measures. For example, the Copenhagen Finger Plan has always been protective of the green wedges from any kind of development over the years. This has been passed on from generation to generation of developers and government officials.

### 8.3.3 Lessons learnt from the four case studies

This section outlines lessons learnt from the four case studies.

a) It is evident from some of the case studies that the involvement of city mayors paved the way for the successful implementation of the projects. The mayors of Curitiba and Seoul had visions to implement these public transport network projects, which were borne during their mayoral campaigns, in the case of Seoul. This was coupled with technical officials who had the skills and knowledge to implement these projects. This was done with the support of officials and public institutes and organisations that provided technical support to the projects. In other words, these cases showed a crucial role that can be played by the involvement of strong political leaders at the local level (municipality) in project implementation. Mayors are one of the highest-ranking political leaders at municipal level and they have political powers to influence project implementation, especially if projects fall within their political mandate.

The South African government has supported the implementation of BRT services in different cities, and this is in line with the Revised White Paper on National Transport Policy published by the Department of Transport in 2021, which supports the establishment of integrated rapid public transport networks (IRPTNs) in large cities with the incorporation of all modes of public transport services such as BRT services, PRASA heavy rail services including Gautrain, minibus taxis and contracted scheduled bus services. This Policy also acknowledged the well-known fact of the slow implementation of projects under the IRPTNs in South Africa. This slow implementation has, at some point, required the Minister of Transport's political intervention. Some projects have been left uncompleted for many years due to many challenges experienced by municipalities or cities.

The issue of institutional arrangements in South Africa with regard to the planning and implementation of public transport projects such as the IRPTNs is particularly important. This includes the devolution of transport functions. The current partial and limited devolution of transport functions is acknowledged in the Revised White Paper on National Transport Policy. With the devolution of functions, it is hoped that there will be "a clear understanding of the transport functions and powers of each level of government to reduce uncertainty in relation to responsibilities and requirements; and facilitate improved transport services and bring government responsibility and public accountability down to the site of citizen interface" (Department of Transport, 2021:54). An emphasis was also made in the Revised White Paper on National Transport Policy that the devolution of functions to the lowest level of government should come hand in hand with full capacitation for proper planning and implementation.

Based on this discussion, it is important that the Department of Transport finalises the strategy on the devolution of transport functions since it will assist municipalities to have a clear understanding of their functions and powers to ensure proper implementation of integrated public transport network projects and land use development coupled with a capacitated local government. The above capacity development is also in line with the Policy statements on human resource development in all three spheres of government, which form part of the Revised White Paper on National Transport Policy.

b) Stakeholder engagement is also important for the success of project implementation. This process ensures that all affected parties are informed about the project to be implemented before implementation to get buy-in from members of the public and other stakeholders, which are key at the project initiation stage. Also, stakeholder engagement facilitates open communication and builds trust between the implementers of the project and the affected parties who may, for example, be local communities and business owners. This was seen in Seoul, wherein delays were experienced when the Seoul Metropolitan Government wanted to implement public transport reforms due to lack of buy-in from members of the public. After the buy-in had been sought, project implementation was possible without further delays.

In the South African context, the GFIP has shown that without stakeholder engagement, mega projects can be put on hold by non-profit organisations, in this case OUTA, members of the public including opposition political parties, which were at the forefront in opposing the electronic tolling (e-tolling) of GFIP due to their dissatisfaction with the way government (SANRAL) had handled stakeholder engagement before the start of this project.

c) A funding framework is needed for funding different phases of projects. The case studies that were explored showed that the cities implemented projects in different phases, and most of them had to use different sources of funding for either Phase 1 or future phases of the projects due to limited funding from government.

Relying on public funds could have delayed funding such big infrastructure projects due to limited budget as was mentioned in some cities. Cities such as Copenhagen and Hong Kong have succeeded in expanding these projects through implementing new phases by using revenue from land value capture.

In South Africa, there has always been a heavy reliance on project funding from national government through National Treasury. This is seen, for example, through various grants across different sectors such as transport, health, social development and basic education for identified infrastructure projects as provided by the Division of Revenue Act (DoRA). As previously mentioned, in the case of public transport network projects such as BRT infrastructure, the Department of Transport is the transferring officer and transfers allocated funds to municipalities to fund these projects across various cities. However, funding is inadequate for public transport network projects as they are also competing with other sector projects for funding or grants.

The Revised White Paper on National Transport Policy discussed the issue of inadequate transport infrastructure investment. This policy maintains that “it is thus critical to establish effective funding mechanisms to support the successful implementation of transport plans and policies, and the closing of the transport infrastructure gap” (Department of Transport, 2021:57). This can be done by looking at both public and private sector funding, and user charges.

There is a need for government to start thinking of innovative ways to fund projects that will improve the public transport system in all provinces and cities. Public-private partnership projects have proven to be successful, for example, in the construction of national toll roads in South Africa. This resulted in SANRAL signing 30-year concession agreements with three concessionaires for building, tolling and operating certain sections of the national road network. Lessons learnt from these agreements by SANRAL could be beneficial for all spheres of government in relation to funding of public transport network development projects. This includes putting in place collaborative efforts between different spheres of government with regard to funding for these projects.

It is encouraging to note that the Department of Transport, in its 2023/24 Annual Performance Plan, undertook to develop a Public Transport Funding Model to address issues of high construction costs that are incurred during the construction of public transport network infrastructure and the operations of the public (Department of Transport, 2023). According to the Department of Transport (2023:340), a Public Transport Funding Model is "used to apply a variety of reliable and sustainable funding revenue or income from various sources that will enable the Department to achieve its vision, aims, goals, mission and objectives". This model will be developed in consultation with key stakeholders such as National Treasury and with considerations of "Legal, Constitutional and Financial implications" (Department of Transport, 2023:340).

d) The four case studies showed that the successful implementation of their respective projects entailed a large-scale implementation of the public transport network improvement project. All these four case studies had a catalytic project for integrated land use transport development, which was implemented in different corridors and/or towns across their respective cities.

This is different from South Africa, where public transport network improvement projects e.g. BRT have been, in most cases, in only one corridor. This has led to low ridership levels and low revenue collection. There is a need for South African cities to expand their public transport network development projects across their cities to have a catalytic effect for social and economic growth and development, and ensure the operational sustainability of the project.

## 8.4 Chapter conclusion

This chapter has synthesised the information that was collected from different case studies into different themes as per the research questions. This was then followed by identifying similarities and differences from the synthesis matrix that was developed in Figure 8.1, which somehow shows that these case studies are all unique in one way or another with some similarities. It also showed that there cannot be a "one size fits all" when one is dealing with public transport issues from different geographical countries with unique and intriguing historical backgrounds.

Under lessons learnt, it became evident that political involvement, stakeholder engagement, funding framework and implementation of a catalytic project for integrated land use transport development on a large scale were crucial for the successful implementation of different phases of BRT or rail transit projects in the four cities.

# 9. CONCLUSION AND RECOMMENDATIONS

## 9.1 Conclusion

The aim of this study was to gain an understanding of changes that have been made by the implementation of the BRT and rail transit systems on urban form, land use patterns and development of the four cities. This was done by answering several questions that were prepared, which focused on the following issues:

- Planning and institutional frameworks.
- Nature of the transport investment.
- Operational arrangements.
- Transport before project implementation.
- Financial arrangements, the impact of the implementation of the system in terms of land value capture, TOD, land use patterns and travel behaviour.
- The measures adopted to attract land use developments to desired locations, and to discourage land use developments from undesirable locations.

Qualitative information was collected from various online documents, namely journal articles from UCT online library and various internet sites, academic research reports and papers from the internet, information from organisational websites in line with the case studies including published Annual Reports, internet information and online newspaper articles.

Based on the information collected, a synthesis matrix was then created, which enabled the capture of the similarities and differences between the case studies under different themes.

One of the similarities in these case studies was that political involvement was present before the implementation of the different projects, even though it was not adequately captured in the Hong Kong case study.

One of the differences was that different funding mechanisms were used to implement these projects. The governments in Copenhagen and Hong Kong solely relied on development rights and land value capture to generate revenue to be used to fund their respective transit projects. In the case of Hong Kong, this included the funding of operations. Curitiba and Seoul relied on funding from government during the first phase, with the Seoul Metropolitan Government continuing to provide subsidies for bus operators in Seoul. What was also different in these case studies was the involvement of the Seoul Metropolitan Government in the daily bus operations, which was not found in other cities.

There were limitations encountered during data collection as some cities lacked detailed information, especially from academic journals, on the nature of the investment and operations of some of the transit systems including planning and institutional arrangements. As a result of this, some information had to be sourced from organisational websites. Information on the impacts of the transit systems, such as

land value capture, was also not easy to find in some cities. This could be because of the type of research conducted by academic researchers in those cities, which could also be dependent on the developments of the cities. There was also limited information on transport planning and institutional arrangements in Hong Kong before the MTR implementation.

## 9.2 Recommendations

The recommendations based on lessons learnt and similarities and differences of the study are found below.

a) Implementation of mega projects cannot be done without political involvement as seen in the case studies. With various challenges being encountered by cities when implementing their respective projects, national and local government need to come together and find ways to support cities during project implementation. The roles and responsibilities of all spheres of government will need to be identified to avoid delays in project implementation, which at times could be more than a year.

   It is thus recommended that the Department of Transport finalise the strategy on the devolution of public transport functions to assist municipalities in having a clear understanding of their functions and powers. This will ensure proper implementation of integrated public transport network projects coupled with a capacitated local government.

b) There is a need for government to revisit issues related to stakeholder engagement. South Africa has, in the past, been affected by delays in project implementation due to stakeholder management matters. This was the same in Curitiba and Seoul before the implementation of their BRT projects. One of the underlying issues with regard to BRT implementation, especially in a developing country such as South Africa, is that there are already public transport operators, i.e. taxi and private bus operators, who always feel threatened by reforms of the public transport industry because their livelihoods depend on making an income from the provision of public transport operations.

   It is recommended that a stakeholder engagement plan form part of the project plan in all government infrastructure projects. This plan would need to include all stakeholders such as members of the public, non-governmenal organisations, business forums, potential private investors in the area, and government officials from all spheres of government, including political leaders. Engagements in the form of open and closed meetings, as well as public forums, would need to be held before, during and after project implementation. Engagements before project implementation would mainly concern project details in terms of its project costs, scope of the project, and job creation opportunities for community members and local businesses (emerging contractors and service providers). During the implementation of the project, one crucial meeting that would need to take place is the introduction of the

contractors and consultants to the stakeholders. This will afford all affected stakeholders an opportunity to know the project-implementing team and to raise any concerns before the project commences. Feedback engagement sessions could then be held from time to time, as and when the need arises, for example, if there are project delays due to financial and technical challenges to avoid any misinterpretations, confusion and spread of lies, as well as ironing out local labour-related problems and during the completion of certain milestones. The final stakeholder engagement could be held during project handover to the relevant authority once the project has been completed. This would provide the stakeholders with the opportunity to view the completed project and, in some cases, the officials could announce future plans if, for example, the project is being implemented in different phases, which is a norm in BRT and rail transit projects.

c) The reliance on the government, for example, in Seoul, to provide bus subsidies to bus operators that are operating the BRT buses has started to have a negative impact on funding for other projects such as rail projects. Seoul Metropolitan Government is struggling to fund both projects.

This challenge is also experienced in the South African context. There is a need for a funding framework for big public transport infrastructure projects in public transport. It may be difficult for South African officials in different spheres of government to come up with such proposals, but currently, the National Treasury is under fiscal stress due to budget shortfalls, increase in debt financing and inflation to adequately fund such projects in the long term. It would be of interest for the country to, for example, learn from cities such as Copenhagen and Hong Kong on how development rights can generate revenue to be used to implement different phases of BRT and rail transit projects.

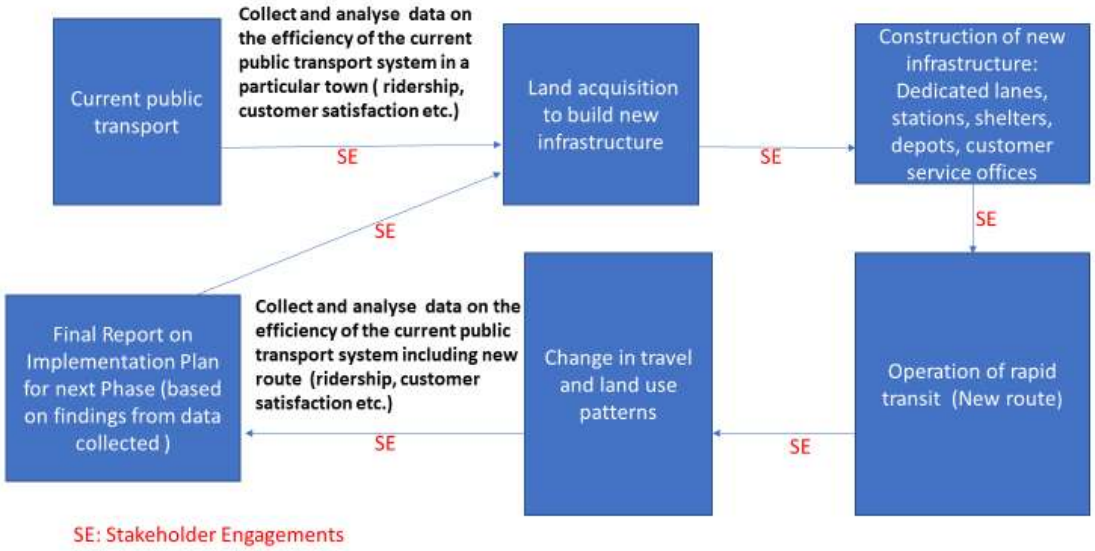
Based on this, it is recommended that the Department of Transport finalise the development of the Public Transport Funding Model to guide funding of public transport infrastructure projects in all three spheres of government. It is envisaged that this model will be able to guide all spheres of government in terms of their roles and responsibilities, as well as forcing local government to take ownership of funding such projects.

As an example, a portion of the revenue collected from property rates and services provided by municipalities could be used to fully or partly fund some of the public transport projects by making special allocations towards these projects to avoid heavy reliance from National Treasury. The size and complexity of the project being implemented would need to be taken into consideration when allocating funds. Municipal Technical Service Units would need to work closely with the Office of the Chief Financial Officer during project and budget planning to ensure proper and fair allocation of resources even if a particular project will partly be funded by national government.

d) There is a need for different cities to continue looking into ways of implementing TOD in their respective cities to increase ridership and patronage.

It is recommended that South African cities expand their public transport network development projects across their cities to have a catalytic effect for social and economic growth, and development. In other words, the scale of the public transport network improvement project across the city needs to be enlarged. This would ensure the operational sustainability of the project in the long run to avoid cases where the government needs to continue subsidising the operations due to low ridership levels, which are unprofitable and unsustainable. This is illustrated in Figure 9.1 below.

**Figure 9.1: Illustrative framework for enhancing public transport network improvements**




It is recommended that cities such as the City of Johannesburg speed up the completion of Phase 1C of the Rea Vaya public transport network so that Rea Vaya can improve its ridership and patronage as Phase 1C is between Alexandra and Sandton. Alexandra is one of the densely populated townships in Johannesburg; and the Rea Vaya will benefit the people of Alexandra and surrounding areas. It is currently estimated that approximately 10 000 people walk between Alexandra and Sandton every day due to high public transport costs or a lack of alternative, reliable transport (joburgetc: 2025). This scenario willl change through the operations of Rea Vaya, which is deemed to be reliable and affordable compared to the public transport services that are currently being offered (joburgetc: 2025).

e) Another recommendation, which was derived from the literature review in Portland city (did not form of the case studies), but may be relevant in the South African context, is developing and implementing a plan that would be similar to the Central City Transportation Plan (CCTMP), which was developed by Portland in 1995. The plan was to promote assurance of liveability with growth,

assurance of mobility with growth, and assurance of liveable streets with growth. In South Africa, this would require municipalities to develop residential areas in town, introduce walkable streets to encourage people that live in town to walk to their places of access, access various amenities; and at the same time, promoting growth through residential and non-residential developments around their town.

One particular example, which the researcher thinks could be related to the above plan, is developments in the City of Tshwane over the past 10 years or loger. City Property, which is one of the many property development companies in Pretoria, also has a big footprint in the Pretoria CBD. Over the years, City Property has converted a number of office buildings into liveable rental apartments. Strict security measures for residents and visitors are applied in these residential buildings, which are situated closer to public transport, retail shops and banks; government buildings (national, provincial and municipal departments); and other social amenities. Residents from these apartments are able to access all amenities within the CBD, mostly by walking. Public transport in a form of BRT (A Re Yeng), municipal buses, minibus taxis and e-hailing services is also readily available. This includes access to Gautrain and PRASA commuter rail services at the Pretoria Station, which is approximately 1,2 km from the Pretoria CBD.

The Pretoria CBD has walkable streets, of which one is Helen Joseph Street (formerly part of Church Street). Three street blocks of Helen Joseph Street are paved blocked sections and promote NMT as they are only for walking. A shopping centre (Sammy Marks Square), the South African State Theatre, retail banks and shops, and government office buildings are situated around and close to the paved blocked sections of Helen Joseph Street. Only delivery vehicles to shops and offices situated in this blocked section can enter this area for a limited period for the purposes of loading and offloading goods.

Another municipality that can benefit from adapting the CCTMP is eThekwini Municipality. This plan can be implemented in the Durban CBD, which reportedly has old buildings, of which some are illegally occupied. The implementation of this plan would renew the Durban CBD, and make it safe and liveable. This would need to be accompanied by the implementation of tight security measures around revamped residential buildings. The Durban CBD still occupies government buildings. Public transport in the Durban CBD is readily available in the form of minibus taxis, municipal buses, commuter trains (Berea and Durban stations) and e-hailing services, including metered taxis. However, it is encouraging to note that “the Durban Point Development Company, co-owned by eThekwini Municipality and Malaysian property group, UEM Sunrise” are responsible for the development of the Durban Point Waterfront (Durban Point Development Company, 2016). The Durban Point Waterfront, which is close to the Durban Harbour, has been developed into mixed used apartments, retail and entertainment complexes, as alluded by Point Waterfront Realty (n.d.). The Durban Point Waterfront is close to Ushaka Marine World (a tourist attraction with restaurants) and beaches. However, some buildings at the Durban Point (not far from the Durban Point Waterfront) are old and would

benefit from the above-mentioned plan. Durban Point is also walkable and a few minutes' walk to the beaches and different amenities in the Durban CBD.

Besides the above-mentioned cities, the CCTMP would benefit many big cities and towns in South Africa.

## 9.3 Areas for future research

The following areas are suggested for future research:

a) Research on the impact of political and technical support during the implementation of public transport network projects in South African cities: Case studies of the Cities of Johannesburg, Cape Town and Tshwane;
b) Research that would cover the financing of public transport projects through land value capture and whether South African cities are ready and able to implement such financing strategies;
c) Funding of BRT and rail transit infrastructure projects through public–private partnerships; and
d) Research on the devolution of transport functions to municipalities and its implications on funding public transport network projects, as well as capacity development at the local level of government.

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