UPPSALA
UNIVERSITET

Master thesis in Sustainable Development 2020/50
Examensarbete i Hållbar utveckling

Paratransit and Bus Rapid Transit Interaction Approaches and Corresponding Barriers

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DEPARTMENT OF
EARTH SCIENCES
INSTITUTIONEN FÖR
GEOVETENSKAPER

Master thesis in Sustainable Development 2020/50
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Published at Department of Earth Sciences, Uppsala University (www.geo.uu.se), Uppsala, 2020

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Messner, L., 2020: Paratransit and Bus Rapid Transit: Interaction Approaches and Corresponding Barriers. *Master thesis in Sustainable Development at Uppsala University*, No.2020/50, 64 pp, 30 ECTS/hp

Abstract
Public transport in many Sub-Saharan African cities consists of paratransit, mini-to-medium-sized buses, which provide public transport and operate demand-driven and unscheduled. This form of public transport is often seen as less safe, less dependable, and environmentally unfriendly. One common intervention is the development of a Bus Rapid Transit system. A Bus Rapid Transit system is characterized by its bus-only lanes and offers a cheaper solution to rail transit systems.

The development of such a BRT system changes the structure of the public transport system as BRT often takes over the areas in which paratransit previously operated. This leads to clashes between the stakeholders of the two modes of transport, which can threaten the success of the system as well as the livelihood of the paratransit workforce. This paper uses socio-technical transition theory, as well as stakeholder theory, to provide a clear picture of the entire land passenger mobility system. The focus of this thesis lies on firstly, analyzing the question why the development of BRT is favored over the optimization of paratransit. Secondly, it looks at different interaction approaches between the multi-regimes scheduled public transport (BRT) and paratransit, which can lead to a successful public transport system. Lastly, socio-technical barriers (political, technical, socio-cultural, and economic) are analyzed to understand which obstacles have to be overcome and what corresponding measures are.

The results show that the development of Bus Rapid Transit is favored over the optimization of paratransit. Paratransit is seen as unsafe and unreliable, while Bus Rapid Transit offers an efficient, reliable, eco-friendly solution which also targets vulnerable groups. Out of the four different interaction approaches, competition between BRT and paratransit, a hybrid form between paratransit and BRT, the replacement of paratransit, and the prohibition of paratransit, the hybrid form is seen as most successful, as it allows both systems to contribute their strengths. Lastly, the actors involved in the socio-technical system, and socio-technical barriers and corresponding measures were analyzed. The biggest take-away when looking at the actors of the land passenger mobility system is that all stakeholders have to be involved, which includes paratransit drivers and people working on and off the vehicles. This paper has shown that when these stakeholders are not included, there might be resistance that might compromise the success of the BRT. The socio-technical barriers used were divided into economic, financial, infrastructural, and socio-cultural barriers. A successful paratransit / BRT interaction benefits from the move from a target system to a monthly salary for the paratransit driver. There should both be regulations and incentives so that paratransit acts as a reliable partner for the BRT system. It should be noted that a successful BRT / paratransit interaction cannot easily be replicated in another country without looking at the urban form preconditions.

Bus Rapid Transit is a feasible solution for many Sub-Saharan cities. For an encompassing public transport system to be successful and to outcompete the car, it is necessary that all stakeholders work together and contribute with their strengths.

Keywords: informal public transport, multi-regimes, socio-technical transition theory, stakeholder theory, Sub-Saharan Africa, sustainable development

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Summary
In many cities in Sub-Saharan Africa, public transport is carried out by paratransit operators. In Kenya, they are called *matatu*, in Ghana *tros tros.* Paratransit differs from country to country, but one thing which unifies them is that they operate unscheduled and demand driven. This form of public transport has its advantages and disadvantages. One the one hand, paratransit offers job opportunities to young, unskilled workers, on the other hand, paratransit is often seen as unreliable. One common intervention to make public transport more sustainable and reliable, is the introduction of a Bus Rapid Transit system. A Bus Rapid Transit system is characterized, among other things, by its bus-only-lanes, while being cheaper than a rail system. The development of such a BRT system changes the structure of the public transport system as BRT often takes over the areas in which paratransit previously operated. This leads to clashes between the stakeholders of the two modes of transport, which can threaten the success of the entire land passenger mobility system.

This paper uses socio-technical transition theory, as well as stakeholder theory, to provide a clear picture of the entire land passenger mobility system. The focus of this thesis lies on firstly, analyzing the question why the development of BRT is favored over the optimization of paratransit. Secondly, it looks at different interaction approaches between the multi-regimes BRT and paratransit, which can lead to a successful public transport system. Lastly, socio-technical barriers (political, technical, socio-cultural, and economic) are analyzed to understand which obstacles have to be overcome and what corresponding measures are.

The results show that the development of Bus Rapid Transit is favored over the optimization of paratransit. Paratransit is seen as unsafe and unreliable, while Bus Rapid Transit offers an efficient, reliable, eco-friendly solution which also targets vulnerable groups. Out of the four different interaction approaches, competition between BRT and paratransit, a hybrid form between paratransit and BRT, the replacement of paratransit, and the prohibition of paratransit, the hybrid form is seen as most successful, as it allows both systems to contribute their strengths. Lastly, the actors involved in the socio-technical system, and socio-technical barriers and corresponding measures were analyzed. The biggest take-away when looking at the actors of the land passenger mobility system is that all stakeholders have to be involved, which includes paratransit drivers and people working on and off the vehicles. This paper has shown that when these stakeholders are not included, there might be resistance that might compromise the success of the BRT. The socio-technical barriers used were divided into economic, financial, infrastructural, and socio-cultural barriers. A successful paratransit / BRT interaction benefits from the move from a target system to a monthly salary for the paratransit driver. There should both be regulations and incentives so that paratransit acts as a reliable partner for the BRT system. It should be noted that a successful BRT / paratransit interaction cannot easily be replicated in another country without looking at the urban form preconditions.

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Abbreviations

BRT	Bus Rapid Transit	1
CFC	Cashless Fare Collection	31
CNG	Compressed Natural Gas	48
GLI	Global Labour Institute	26
IPT	Intermediate Public Transport	1
ITDP	Institute for Transportation and Development Policy	26
ITF	International Transport Workers' Federation	26
MBT	Minibus-taxis	24
MLP	Multi-level perspective	5
SACCOs	Savings and Credit Cooperatives	31
SDG	Sustainable Development Goals	2
ST	Stakeholder Theory	11
TOC	Taxi Operating Company	25

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1 Introduction

The introduction focuses on the problem background, namely that the introduction of Bus Rapid Transit changes land passenger mobility system. This chapter also introduces the research questions and gives an outline of the thesis.

1.1 Problem background

By 2050, the global population could grow to 9.7 billion, and half of this growth could happen in countries of Sub-Saharan Africa (**SSA**) (United Nations, 2019, p. 1). With more people living on this earth, public transport will have to take an increasing number of people from A to B. At its current stage, the system faces many challenges. More than one billion people are still not connected to education, health centers, and jobs in rural areas, and the transport sector still emits too much CO_2 (Sustainable Mobility for All, 2019).

In many countries in the Global South[1] where there is a lack of scheduled[2] public transport, informal public transport, also called paratransit or Intermediate Public Transport (**IPT**), is common[3] (gtz, 2010). Forms of paratransit are *becak* (pedicabs) and *ojek* in Indonesia (Cervero & Golub, 2007) and *matatu* in Kenya (Khayesi, *et al.*, 2015). The advantages of paratransit are jobs for low-skilled workers a flexible, demand-driven design (Cervero & Golub, 2007). Nevertheless, paratransit systems have also been described as less safe, less dependable, and fares frequently vary (Klopp, et al., 2019). Therefore, it is essential to build an encompassing, smart, safe, efficient, accessible, and green public transport that caters towards all people, including vulnerable groups (Sustainable Mobility for All, 2019).

Necessary stakeholders to achieve this outcome are both public and private actors. Transport vehicle providers, such as the Swedish manufacturer Scania, are needed to provide the necessary equipment. Public actors, such as governmental institutions and intergovernmental organizations (e.g., World Bank), have to develop projects and accumulate the funding to foster public transportation projects.

One of these public transport interventions is the so-called Bus Rapid Transport (**BRT**) system. The first system was installed in Curitiba, Brazil, and has now been imitated in many other parts of the world (Wijaya & Imran, 2019). Characteristics of a BRT system are its bus-only lanes and its promise to make the commute as comfortable and safe as possible (Institute for Transportation & Development Policy, n.d.). Additionally, a BRT system offers many of the benefits of a rail transit system while also being cheaper (Racehorse, *et al*., 2014).

BRT systems are also built as part of making public transport more sustainable. By creating 25,000 km of new BRT lines in the entire world, cities are trying to reach the global emission reduction targets (Dulac, 2013) as well as including lower-income communities in many developing cities (Venter, *et al*., 2018). The hybrid buses used in the BRT system in Curitiba, Brazil, for example, emit 30% fewer greenhouse gases than a conventional bus (Dreier, *et al.*, 2018, p. 122)

[1] The word Global South refers to a part of Latin America, Asia, Africa, and Oceania and is used to place the focus on "geopolitical relations of power" instead of on how regions / countries differ culturally (Dados & Connell, 2012, p. 12)

[2] In this paper, the word scheduled public transport regime is used rather than formal public transport as paratransit can, in certain cases, also be formal. Nevertheless, the words formal for scheduled public transport is often used in literature and interviews.

[3] From here on, only the word paratransit will be used although the word informal is often used in literature and interviews.

1.2 A commission

This paper is written in collaboration with the Swedish heavy truck manufacturer Scania, which has been involved in the development of BRT systems in numerous cities, such as Bogotá, Colombia, Rio de Janeiro, Brazil, and in cities in Ghana (Scania, n.d.). The most significant focus of building such a BRT system lies in making it as sustainable as possible, which includes the delivery of gas buses and workshops for bus drivers (Scania, 2019).

1.3 Problem

BRT systems are seen as one of the best solutions battling the rising numbers of people living in dense areas (Merkert, *et al*., 2017). Nevertheless, BRT providers are often facing different challenges, one being the integration of paratransit already in place in the chosen city. A consequence of this is that if the local bus service is not integrated into the BRT system, customers cannot differentiate between the two, and the BRT system might not achieve its goal (Satiennam, *et al*., 2006).

Another problem is that during the development of the BRT system, the paratransit regime is often not involved. This lack of paratransit inclusion leads to different issues such as less income, fewer employment opportunities, and less decision power for the paratransit workforce (Schalekamp & Behrens, 2010). The BRT System in the Gauteng Province in Johannesburg has, for example, led to a loss of revenue for taxi owners (Rahim, 2014).

These challenges lead to a discrepancy between the sustainability that modern cities want to achieve and the reality of job loss and, therefore, miss of the Sustainable Development Goals (**SDG**). SDG 8 (inclusive and sustainable economic growth), 9 (resilient infrastructure), and 11 (inclusive and safe human settlements) all focus on how to make a city more inclusive and sustainable (Figure 1).

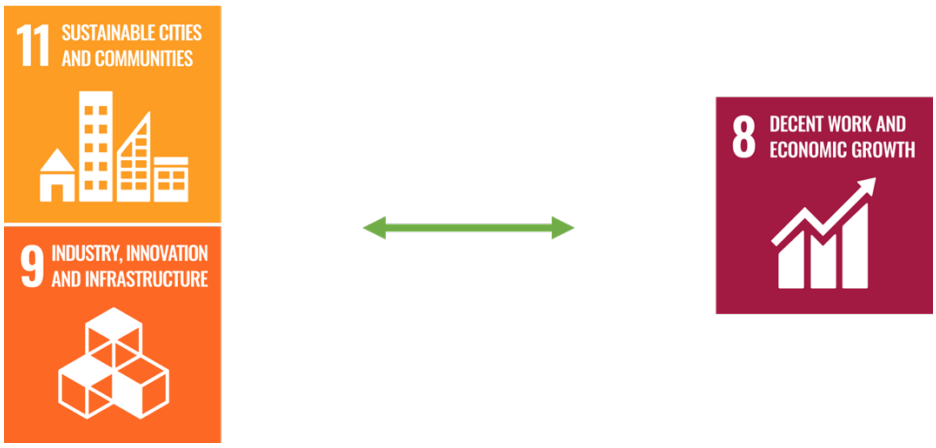

Figure 1. The SDGs.

Introducing a new transport system promotes especially target 9.1, "to develop quality, reliable, sustainable and resilient infrastructure (…)" and 11.2, "by 2030, provide access to safe, affordable, accessible and sustainable transport systems for all (…)" (United Nations, 2015). At the same time, it might hurt SDG 8, and especially target 8.5, "to achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities (…)" if the building of the new infrastructure results in job loss for the paratransit workforce. The inclusion of paratransit within the scheduled system has to, therefore, take all, but especially these three SDGs equally into account to make a city genuinely sustainable (United Nations, 2015). .

This paper focuses on transport planning in African cities as it has been underreported on and underfinanced (Sudmant, *et al*., 2017). Many transport systems in Africa also do not focus on the

inclusion of vulnerable groups[4], both the passengers as well as drivers of the system (Ezeibe, *et al.*, 2017). Often, paratransit regimes are seen as a hindrance when it comes to the implementation of a new BRT system and are not considered as a primary factor in the success. If the goal is to build an encompassing, smart, safe, efficient, accessible, and green public transport for all, paratransit systems have to be in the focus from the beginning of the planning process (Klopp & Cavoli, 2019)

1.4 Aim

This paper aims to explain what interaction approaches between scheduled public transport (BRT) and paratransit there are. Especially the livelihoods of the drivers working in the paratransit workforce are in the focus of the paper. In the next step, this paper looks at barriers and corresponding measures which hinder a successful interaction between the scheduled public transport (BRT) and paratransit.

- In which way can paratransit and scheduled public transport (BRT) successfully interact?
- What are socio-technical barriers and corresponding measures for a successful interaction between scheduled public transport (BRT) and paratransit?

1.5 Outline

Figure 1 shows how the study is structured in eight different chapters that build on each other. This structure can be used as a guide while reading this thesis.

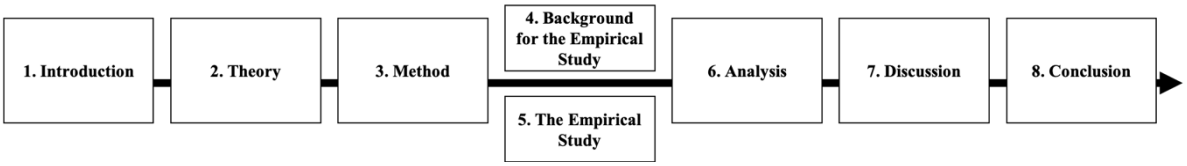

Figure 2. Outline of the study.

Chapter 1 describes how a continuously growing world has to deal with the demand for a functioning public transport and then leads into the topic of this paper, namely the research of approaches regarding paratransit once a Bus Rapid Transit system is developed.

Chapter 2 of this paper focuses on the theory used to support the following research. It will first introduce socio-technical transition theory. The next stance will show that this theory lacks a particular focus on the Global South. Then, socio-technical theory will be combined with stakeholder theory for the conceptual framework.

Chapter 3 introduces the two methods used – namely, literature review and semi-structured interviews. In the next step, the way the collected data is analyzed is introduced. All data has been compiled following certain ethical aspects.

Chapter 4 includes the necessary background before diving into the empirics. Terms required to understand the rest of the paper, such as paratransit and BRT, are being explained.

Chapter 5 reveals the results of the interviews conducted and clusters them according to the research question. The focus, therefore, first lies on interaction approaches and then on barriers hindering these interactions,

[4] Characteristics on how to define vulnerable groups include factors such as age (e.g., elderly people), race, gender (e.g., female vs. male), and demographics (e.g., homeless people) (Shi & Stevens, 2005).

Chapter 6 analyses the interviews as well as the literature review, following the theory section. This chapter is divided to first look at the interaction approaches and focuses then on human actors as well as political, economic, technological, and socio-cultural barriers.

Chapter 7 discusses the findings and relates them to the research question. Other points, which were discovered during the research, such as how the SDGs relate to paratransit, as well as other feeder solutions, are discussed.

Chapter 8 summarizes the learnings so far, shows how this paper has contributed to the current research gap and suggests what future research can focus on.

2 Theory

This chapter looks at the theories used for conducting the research of this paper. As a first step, socio-technical transition theory is explained to understand the different transport regimes and the introduction of BRT as a radical innovation. Then, limitations of socio-technical theory are addressed, firstly in a general context and then in connection to the Global South. Lastly, socio-technical transition theory is narrowed down to the field of paratransit. As a second theory, stakeholder theory gets introduced and combined to a conceptual framework.

2.1 Socio-technical transition theory

In the 21st century, different systems, such as transportation or nutrition, have undergone so-called socio-technical transitions (Spickermann, *et al*., 2014). Sustainable socio-technical transitions specifically focus on shifting to a more sustainable mode of how to produce and consume (Markard, *et al*., 2012). Another characteristic of sustainable socio-technical transitions is that the innovation is often not able to compete with the existing technologies without, e.g., governmental subsidies (Geels, 2011). To further the transition to sustainability in the transport sector, changes in user practice, cultural behaviors, the market, as well as the introduction of new technologies, have to be considered (Geels, 2004).

It is essential to look at the entire system and its actors to understand socio-technical transitions. According to Geels (2004, p. 900), a socio-technological system is characterized through "artefacts, knowledge, capital, labour, cultural meaning" and specifically includes the "user side." Human actors are the ones building these socio-technical systems, and actors are classified into different groups such as "firms, industries, users, societal groups, public authorities and research institutes" (Geels, 2004, p. 900). Social groups are characterized by being able to act relatively autonomously as well as sharing specific characteristics such as the way they speak, certain hobbies, or views (Geels, 2004). Groups are, therefore, both formed by their interpenetration (groups can interact with each other but do not lose their autonomy) (Stankiewicz, 1992, p. 20) as well as inter-group coordination (social groups and their activities are coordinated with each other). This set-up is called "meta-coordination" (Geels, 2004, p. 901). Social groups are also not static; they change and form new groups over time (Geels, 2004).

2.1.1 Regime dimensions

As written before, socio-technical transitions include shifts in, for example, the following dimensions: cultural and symbolic meanings, finance rules, regulations and policies, vehicle/artefact, market and user practices, maintenance and distribution networks, industry structure, and technology (Figure 2) (Geels, 2005, p. 1258). Geels (2002, p. 1258) describes these dimensions as "configurations" which fulfill societal functions.

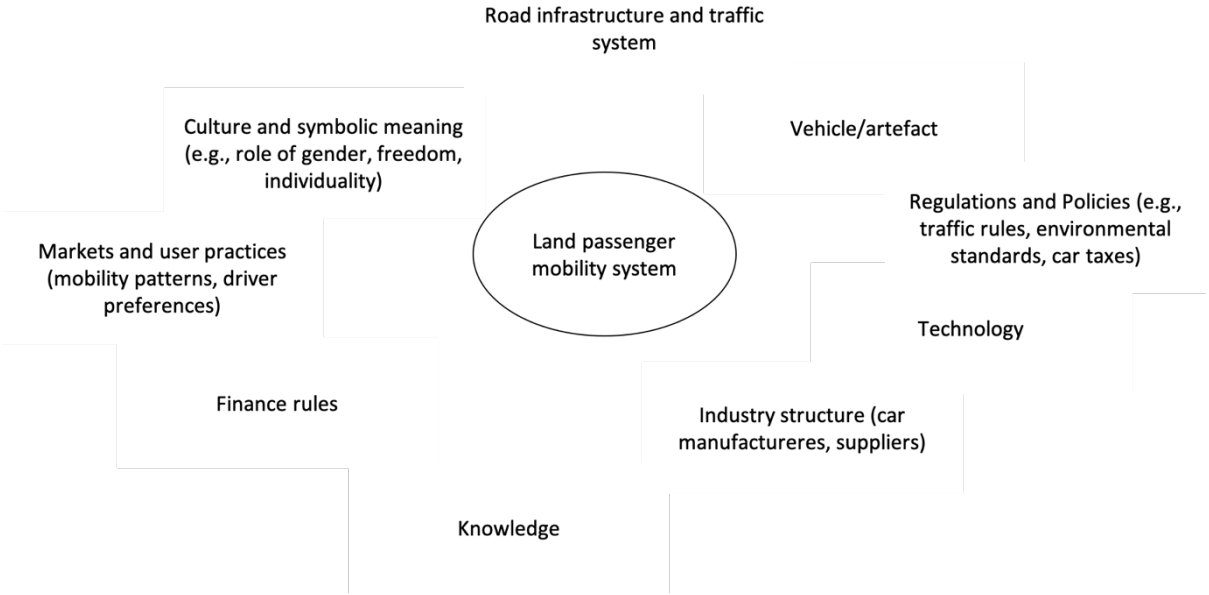

Figure 3. Socio-technical dimensions in land passenger mobility systems (inspiration from Geels, 2002, p. 1258 with minor modifications).

The dimensions shown in Figure 2 have been adapted to the land passenger mobility system. The elements in this configuration are linked to each other and aligned with the currently existing technology and provide stability (Geels, 2002). Geels (2002) mentions the transport ministries, who are responsible for the road infrastructures and car regulations. The interaction between users, on the other hand, produce cultural and symbolic meanings.

2.1.2 The Multi-Level Perspective (**MLP**)

The "Multi-Level Perspective" (**MLP**,) which is divided into three different levels, is a useful approach to explain that transitions occur through interactions between processes at the landscape, regime, and niche level as can be seen in Figure 3 (Geels, 2004, p. 899; Geels & Schot, 2007).

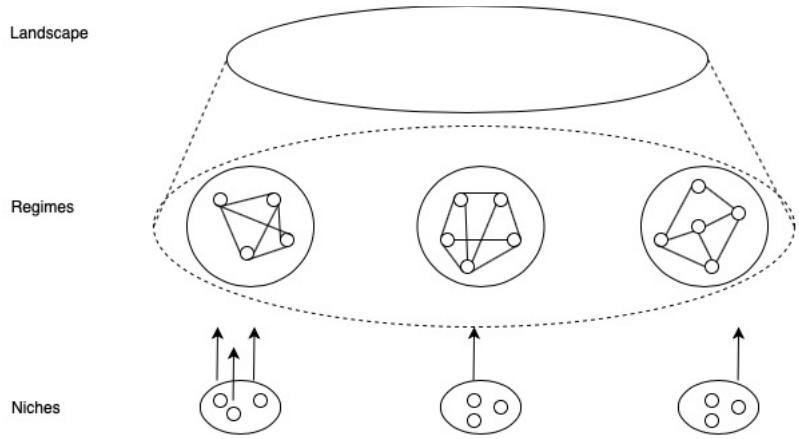

Figure 4. The interconnection of landscape, regimes, and niches (Geels, 2002, p. 1261 with minor modifications).

The term *landscape* describes an abstract concept in which socio-technical development takes place (Geels, 2012). Its exogenous environment characterizes the landscape level, it is moved by long-term trends and seldom by significant events, and it cannot be influenced by the actors directly (Geels, 2004). A critical example in the transport sector, which exemplifies the pressure on the regime due to changes in the landscape, is climate change (Geels, 2004).

The *regime* level stands for the institutions of a system, which fulfill a societal function. The socio-technical regime, therefore, includes different regime dimensions, such as the "technological regime, science regime, policy regime," which are all managed by social groups and act through the previously introduced notion of meta-coordination (Geels, 2004, p. 906). Changes in regimes are often challenging to convey, as there are aggravating mechanisms, such as economic barriers, as well as specific regulations, or an already existing infrastructure (Geels, 2012).

The *niche* level is where new inventions are introduced and tested in a vacuum (Geels, 2002). Niches are needed for these "radical innovations" since this is the space where learning occurs, and mistakes are allowed to be made (Geels, 2004, p. 910). New social networks are formed at this level to support innovations (Geels, 2012). There are several barriers an innovation has to overcome to be successful: political (regulations), socio-cultural (user practices), technical (infrastructure, maintenance networks), and economic (financing, maintenance) (Geels, 2002). The different levels are embedded within each other, the regime within the landscape, and the niche within the regime (Geels, 2002), but should not be seen as a "nested hierarchy" (Geels, 2011, p. 37).

2.1.3 Regime transitions

According to Geels and Schot (2007), regime transitions occur through interaction between the three different levels and lead to one socio-technical regime replacing the other. At the niche level, the innovation is tested, improved, tested again, as well as supported by influential groups. At the same time, the landscape level changes and puts pressure on the regime level. The regime level, on the other hand, gets destabilized, which creates an opportunity for the innovation at niche level to breakthrough. Through these processes, the innovations can make their way into the mainstream, in which they face competition of the regime, which is currently in place.

Geels and Schot, based on Smith, *et al.* (2005), introduce four transition pathways that lead to a regime shift, as shown in Table 1. The transition pathways highlight timing, which relates to at what point the landscape puts pressure on the regimes and how developed the niche innovation is (Geels & Schot, 2007). The transition pathway, therefore, is different depending on how advanced the niche innovation is. There might not be any shift at all since the window of opportunity might close if a niche is not fully developed.

Table 1. Transition pathways and actors involved based on Geel & Schot (2007, p. 414)

Transition pathways	Main actors
Transformation	Regime actors, outside groups
Technological substitution	New firms vs. incumbent firms
Reconfiguration	Regime actors, suppliers
De-alignment and re-alignment	New niche actors

In the *transformation pathway*, the landscape puts pressure on the regime. This pressure is moderate, and regime rules are adjusted gradually. Outside groups are the ones that react to the landscape pressure and make regime insiders aware of it. The new regime is, therefore, evolving out of the old regime (Geels & Schot, 2007).

The second one is *technological substitution*, where one niche innovation has already been thoroughly developed and thus competes with and replaces the regime in place. In this pathway, the only reason why the innovation has not broken through earlier is that the regime is relatively stable. What is needed for the radical innovation to make its way from niche to regime, is a "specific shock" coming from the landscape (Geels & Schot, 2007, p. 410).

In the *reconfiguration* pathway, niche innovations have been invited by regime actors to address particular problems. Subsequently, these niche innovations lead to further adjustments to the regime. These adjustments can happen if the niche innovation has "symbiotic relations" with the existing regime (Geels & Schot, 2007, p. 411). The reconfiguration pathway is similar to the transformation pathway, only that it goes one step further as it also changes the architecture of the regime.

The last one, *de-alignment and re-alignment*, happens as there is pressure on the regime due to shifts in the "deep structures," that is to say the landscape level, and more than one novelty competes to become the innovation to succeed (Geels & Schot, 2007, p. 414). Everything happens much more rapidly, and the regime is not able to cope with the pressure coming from the landscape. Since the innovations at niche level had not been thoroughly developed, multiple niche-innovations compete for their break-through until one innovation succeeds and "re-alignment and re-institutionalization" of the new socio-technical regime follow (Geels & Schot, 2007, p. 408).

The transitions shown in Table 1 are not a guarantee that a new socio-technical regime develops. Additionally, the transitions can take different forms and include other actors than described above. A combination of different transition pathways is also possible and with such powerful landscape changes such as climate change, very likely (Geels & Schot, 2007).

2.1.4 Multi-regime interactions

The different transition pathways introduced by Geels and Schot show how a regime can change depending on the pressure coming from the landscape and / or the development of a niche innovation. According to Raven and Verbong (2007), regime boundaries are crossed once a niche innovation breaks through. Producers of regimes, which previously did not work together, might start cooperating, or actors may play different roles in each system (Raven & Verbong, 2007). In the following section, four different interaction types, namely *competition, symbiosis, integration,* and *spill-over*, are introduced to show how multiple regimes may behave now.

The first one is *competition*, which happens when the regimes behave similarly. The regimes compete for different things, "raw materials or access to infrastructure" (Raven & Verbong, 2007, p. 502). If this is the case, then there are multiple following scenarios: one regime takes over, or the regimes stay in place and continue to compete. The second type of interaction is *symbiosis*. Here, the regimes cooperate, benefit from this cooperation, and grow stronger by collaborating. The third interaction type is *integration*, where one of the regimes gets absorbed by the other one. The last interaction type is *spill-over*, where rules and regulations from one regime are now also applied to the other.

It should be mentioned as a side-note that these interaction types are not exclusive and that the interactions can shift from one type to the other (Sutherland & Zagata, 2015).

Geels builds onto this notion of multi-regimes and adds that mobility systems are not independent of other influences since mobility is a "derived demand," which helps to fulfill different parts of life such as going to work, visiting a doctor or friends, or for travel (Geels, 2012, p. 88). He also argues that it is not only essential to look at how different regimes act within or between other regimes, but also how there are multiple landscape dynamics which influence regimes, and that there are numerous niche innovations that should be taken into account (Geels, 2012, p. 88).

2.1.5 Barriers and enablers of sustainability transitions

Successful transitions need to overcome different barriers such as economic, political, technological, socio-cultural barriers (Egbue & Long, 2012). These barriers can be found on all three levels of the MLP. These barriers will also be used in this thesis to analyze the obstacles multi-regimes have to overcome for a successful interaction.

Economic barriers relate to costs for both consumers and investors, as well as support from the government, e.g. "subsidies and direct grants" (Browne, *et al.*, 2012, p. 142). Technological barriers can occur at the corporate or systemic level. Browne, *et al.* (2012, p. 144) classify technological barriers into (a) technological barriers; (b) infrastructure barriers; and (c) uncertain raw material availability. Political obstacles, in other research also called "institutional and administrative barriers" (Browne, *et al.*, 2012, p. 145), include changes in regulation, corruption, and lack of institutional capacity (Sovacool & Bambawale, 2011). Socio-cultural barriers are knowledge the consumer has, or the commitment of actors (Noel, *et al.*, 2020). Examples of such socio-cultural barriers on regime level are local opposition (Sovacool, *et al.*, 2011)

When it comes to classifying socio-technical barriers, it should be noted that these do not exist separately but are interconnected (Noel, *et al.*, 2020). Furthermore, while the barriers are not organized hierarchically, it might be the case that some barriers are perceived as more critical (Sovacool, *et al.*, 2011).

2.2 Criticisms of the MLP

Chapter 2.2 and 2.3 both focus on critiques of the MLP. Chapter 2.2 deals with general critiques, which have mostly been debunked by Geels himself. In contrast, chapter 2.3 focuses on how the MLP has to be adapted to be helpful when looking at socio-technical transitions in the Global South.

Geels addresses seven criticisms regarding the MLP. The seven criticisms are as followed: (1) lack of agency, (2) operationalization of regimes, (3) bias towards bottom-up change models, (4) epistemology and explanatory style, (5) methodology, (6) socio-technical landscape as a residual category, and (7) flat ontologies versus hierarchical levels (Geels, 2011, p. 24).

While all of these criticisms are important and should be considered when it comes to transition theory, this paper addresses the critique one, six, and seven. The reasons why the other critiques are not addressed are either because they were not deemed relevant for this paper (2, 4, 5), or because they are treated at a different point (3 included in chapter 2.1.2). For a more in-depth insight, the Geels (2011) paper is advised.

The MLP has been criticized for its lack of agency, and critics have called for a more substantial inclusion of power and politics (Genus & Coles, 2008; Smith, 2007). While Geels argues that agency has always been part of the MLP in the form of "bounded rationality," he agrees that certain types of agency can and should be added. These types include "power, civil society and cultural dimensions," as well as a stronger focus on regime actors (Geels, 2011, p. 30). Stakeholder theory has, therefore,

been included in the conceptual framework. Concerning paratransit and BRT, agency is an essential aspect to consider and will be exemplified in the analysis.

Another critique included here is "socio-technical landscape as a residual category," which refers to that the landscape level is broadly defined and consists of a broad array of influences (Geels, 2011, p. 36). To improve the landscape concept, the following dynamics should be used to analyze it: (1) not-changing factors (2) rapid external shocks, and (3) long-term changes (Driel & Schot, 2005, p. 54).

The third factor is "flat ontologies versus hierarchical levels" and argues that although the MLP is characterized by its "micro-meso-macro" level, which alludes that the MLP is hierarchical when the three different levels are only used to show "stability" (Geels, 2011, p. 37). This differentiation is also made clear in chapter 2.1.2, and the MLP should, therefore, be seen as a "flat approach" rather than a hierarchical one (Geels, 2011, p. 38).

2.3 Socio-technical transition theory in the Global South

Building on to the critiques addressed in chapter 2.2, three problems concerning the socio-technical transition theory, specifically regarding the Global South, are focused on in this chapter. Firstly, the question of who benefits from innovation, secondly, if innovation is always the best way to achieve sustainability, and thirdly, that the descriptions of the regime levels differ in the Global South.

The question that often remains unanswered is for whom these transitions are and for whom these innovations are created for on niche level. The implicit definition of transformation and innovation is to change the current state into something better, and while ongoing innovation often focuses on environmental transformation, the social aspects, the so-called "socio-institutional sustainability," are overlooked (Romijn, *et al*., 2010, p. 335). Therefore, the socio-technical transition theory needs to be adapted to the Global South, where the environmental goals have to be connected with social goals such as poverty reduction and local community development (Romijn, *et al*., 2010).

Furthermore, there seems to be a Western bias if the focus is solely on transitions as regime-shifts (Ghosh & Schot, 2019). In many cities of the Global South, the focus of regime shifts is on upgrading the current system and not on introducing niche innovations as it is the case in the Global North (Ghosh & Schot, 2019). Many studies focus solely on the necessity of having a destabilized regime and a novelty created at niche level for a regime to transition (Geels, *et al*., 2017). Gosh and Schot (2019, p. 83), on the other hand, place their emphasis on the change coming within the regime and propose to focus on *regime optimization*, *regime transformation*, as well as *regime transition*, as shown in Table 2. There are several factors that have to be looked at to know which regime change too place. Firstly, by looking at how many regime dimensions change. Secondly, which rules change, and thirdly if the change is due to ex-post or ex-ante pressure.

Table 2. Regime changes in the Global South (Gosh and Shot, 2019, p. 83 with minor modifications)

Regime change	Regime dimension change
Regime transition	Change in all five regime dimensions
Regime transformation	Change in three / four regime dimensions
Regime optimization	One regime dimension (at least)

Gosh and Schot (2019, p. 85) describe "science and technology," "policy and governance," "market and users," "industry structure and strategy," and "socio-cultural dimension," as the regime dimensions in which transition could occur, which have to be identified as a first step to understand a regime change. As a second step, changes in rules have to be identified. Gosh and Schot (2019, p. 85) detect three changes in rules: change in "regulative rules," change in "cognitive rules," and change in "normative rules." Normative rules are most likely to be shared by all dimensions, whereas cognitive and regulative rules are depending on each regime dimension. As the last step, Gosh & Schot identify if the selection pressure is ex-ante or ex-post. The former meaning giving response to problems already existing,

whereas the latter anticipates future issues that cannot be solved through the current rules (Ghosh & Schot, 2019, p. 85).

All regime dimensions are changed in *regime transition*. All three types of rules are changed. The *regime transformation* pathway takes place in three or four regime dimensions. Both regulative and cognitive rules are changed. There are indications that normative rules might also shift. Change is ignited by both ex-post and ex-ante pressures. *Regime optimization* takes place at a maximum of two regime dimensions. The rule changes are regulative; no change in the normative rules is taking place. The change happens ex-post. Here, the section pressure is ex-ante, which gives way to the creation of niches. By looking at these three pathways, changes can be analyzed more "nuanced and fine-grained" than before (Ghosh & Schot, 2019, p. 92).

The transition pathways presented by Ghosh & Schot (2019) are helpful concerning the Global South since the other transition pathways presented before by Geels & Schot (2007) primarily focus on niche innovation. Including optimization as its own transition pathway might prove useful when looking at a nonwestern context (Ghosh & Schot, 2019).

Lastly, the description of the regime levels differs in the Global South, according to Ramos-Mejía, *et al.* (2018). The researchers describe the landscape level characterized by "informal security and insecurity aspects," which include "exploitation, exclusion, domination, and oppression" as main factors (Ramos-Mejía, *et al.*, 2018, p. 219). In the Global South, the regime level also includes informal markets as well as patriarchal structures in the household (Ramos-Mejía, *et al.*, 2018). On niche level, several other factors have to be taken into account, as for example "networking when constructing a niche" (Ramos-Mejía, *et al.*, 2018, p. 221), since many of the relationships in the Global South are "hierarchical and clientelist" (Wood & Gough, 2006, p. 1696)

To understand socio-technical transitions in the Global South, it is, firstly, vital to look for whom the transition is there for. Secondly, it is essential to understand what the different pathways are. Thirdly, it has to be understood that a high social complexity characterizes the MLP in the Global South compared to a western context (Ramos-Mejía, *et al.*, 2018).

2.4 Socio-technical transition theory and mobility regimes in the Global South

Many researchers have focused on the socio-technical transition of mobility, such as the change from horse carriages to cars (Geels, 2005), or the introduction of biofuel as a radical innovation (Kim, *et al*., 2019). Socio-technical transition theory has been used to describe the development of a BRT system. Still, the paratransit regime has just been mentioned as a barrier to the success of the BRT system ("competition with other systems/solutions") (Mejía-Dugand, *et al.*, 2013, p. 13) Paratransit regimes have, therefore, rarely been included in the regimes describing mobility (Sengers & Raven, 2014).

This paper includes paratransit as a socio-technical regime, next to the scheduled public transport regime, and the private transport regime because they consist of their own "actor-networks," as well as rules and regulations the actors follow (Canitez, 2019; Ghosh & Schot, 2019, p. 85; Sengers & Raven, 2014). All of these three regimes consist of further sub-regimes as well and include "rules, regulatory environment, institutional arrangements, and governance practices" (Canitez, 2019, p. 320).

Socio-technical transitions in the Global South are harder to grasp because of their complexity (Ramos-Mejía, *et al.*, 2018). The example of paratransit and scheduled public transport shows precisely that complexity. While the focus of city planners is often on how to achieve a green and modern city, paratransit, although seen as an environmentally unfriendly solution, provides job opportunities and access to transportation for disadvantaged groups which is and should be a key priority of sustainable development as well (Sengers & Raven, 2014). Furthermore, the experiences in a Western European

context differ from the one in an SSA context, as mentioned before, and for the transition to be successful, it is crucial to understand the dynamics and power of the context first (Raven, *et al*., 2017).

As written in chapter 2.1.2, the MLP is used to describe changes in socio-technical systems that are composed of a landscape, regimes, and niches. In Figure 4, Geels' MLP figure is adjusted to the topic of this paper, and scheduled public transport, as well as paratransit and private transport, are included as co-existing regimes.

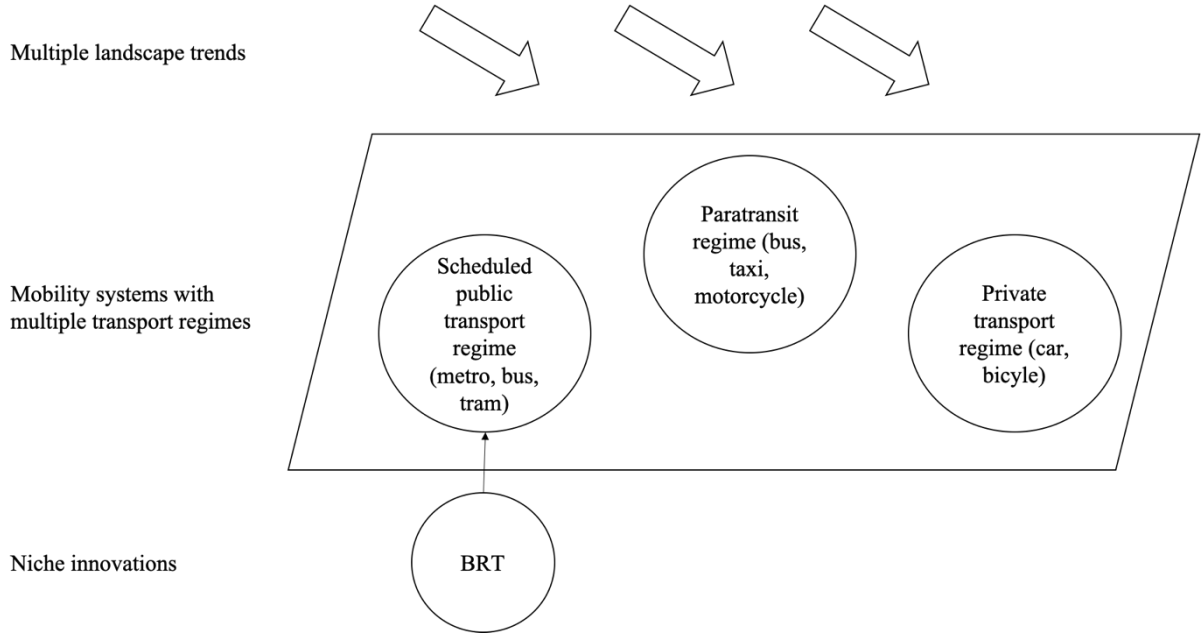

Figure 5. Mobility system with multiple transport regimes (Geels, 2018, p.88 with minor modifications).

There are different mobility systems, which can operate on air, land, and water (Geels, 2018). This paper focuses on the land passenger mobility system, which is divided into scheduled public transport, the paratransit, and the private transport regime. All of these regimes consist of other sub-regimes (metro, tram, bicycle), which are called "subaltern regimes" (Geels, 2012, p. 473). BRT is seen as a niche invention, which can break through into the public transport regime since there is, e.g., pressure coming from the landscape (e.g., climate change) (Sengers & Raven, 2015). BRT is, therefore, seen as a "means to achieve transformation" (Mejía-Dugand, *et al.*, 2013, p. 83). After BRT breaks through, it changes how the public transport regime acts profoundly. But it does not only change the public transport regime, but also the paratransit and private transport regime. This thesis specifically focuses on the interaction between the scheduled public transport regime and the paratransit regime after BRT broke through and became a crucial part of the scheduled public transport regime.

2.5 Stakeholder theory

The brief introduction into socio-technical transition theory and its shortcomings regarding the Global South showed that the inclusion of all actors is crucial to make the project a success. By including the stakeholders, how a regime should shift can be understood more easily. Stakeholder theory and stakeholder mapping can, therefore, be a useful tool to distinguish actors.

Stakeholder theory (**ST**) was, amongst others, developed by R. Edward Freeman (Freeman & McVea, 2001), and it includes besides the shareholders any other groups that are affected by the development (Freeman, 1984). The theory has been criticized since empirical validity is still lacking in multiple critical aspects. Furthermore, it has been criticized that the primary concern of the theory is focused on profit making (Laplume, *et al.*, 2008). Nevertheless, with regards to this research topic and to the previously introduced socio-technical transition theory, which continuously states the importance of inclusion of its actors, stakeholder theory is used in this paper.

Donaldson and Preston (1995) argue that ST encompasses three core aspects.

- ST is "unarguably descriptive," as it describes the stakeholders, as well as their interests and relationships (Donaldson & Preston, 1995, p. 66).
- ST is also "instrumental," which means that it analyses the connections between the management of the stakeholders and the performance goals of the corporation (Donaldson & Preston, 1995, p. 67).
- ST is "normative," which acts as the core of ST by analyzing the motivations of the stakeholders and examines how the stakeholders should act (Donaldson & Preston, 1995, p. 66).

By including these three aspects, it helps to understand who the stakeholders in a project are, which goals and values they are pursuing, and how the connection between the different stakeholders affect the development of the project.

There are many different ways on how to divide stakeholders. This paper follows the approach by Roberts (2003, p. 162), who groups stakeholders into the following roles: authorizers, business partners, external influencers, and customers. Authorizers are the ones authorizing an organization as well as continuously supervising its performance. Business partners are in charge of the operations. Employees and suppliers can be counted in this group. External influencers are, for example, NGOs, community groups, and media who are interested in the organization as it impacts others. Lastly, customers are included, who access the product differently and have, therefore, a different viewpoint on the reputation of the company.

2.6 Stakeholder theory and public transport in Sub-Saharan Africa

Transport planning is often conducted following a "DAD (Decide, Announce, Defend) approach," which neglects many of the previously named stakeholders and leads to the miss of opportunities (Cascetta & Pagliara, 2013, p. 103). It is, therefore, crucial to involve all stakeholders as the decisions made have a profound impact on all stakeholders involved (Pira, *et al*., 2016). Figure 5 shows the stakeholders involved in the construction of a new BRT system.

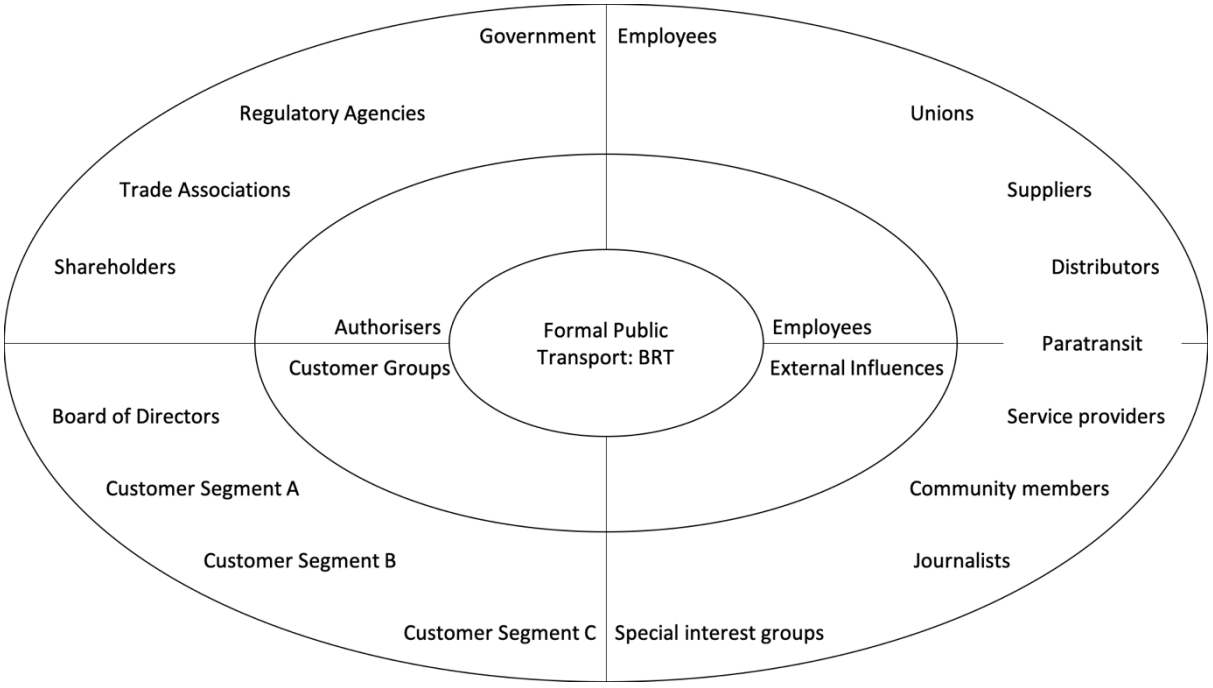

Figure 6. A stakeholder illustration focusing on roles in the scheduled public transport system (inspired by Roberts, 2003, p.162, with adaptions to the project).

In this figure, BRT is seen as part of the scheduled public transport regime; paratransit is another regime, which, depending on which regime shift is taking place, can function as both business partners and external influence, or only as an external influence. Especially in SSA where many transport decisions have been made based on Western knowledge, it is necessary to decolonize the knowledge about transport and involve "indigenous communities" and the perspectives of, for example, *matatu* drivers and *boda boda* conductors (Schwanen, 2018, p. 5). Other stakeholders, which should be included in conversations regarding approaches of the involvement of paratransit, include, for example, the operators of the paratransit, the drivers and conductors, the users, regulators and civil associations (unions), the support industry, and the rest of the community (Graeff, 2009). In Nairobi, for example, the paratransit stakeholders can be divided into three groups (GLI, 2019, p. 17):

- On-board crews: drivers, conductors, squad drivers, squad conductors, kamagera drivers, kamagera conductors
- Stage workers: sacco supervisors, supervisors, sacco agents, owners' agents, stage attendants, callers (mananba), money changers, loaders / porters, vendors, shoe shiners, 'seat warmers' (piggaseti), side mirror menders, bus sweepers, police agents, traffic marshals, 'cartel' workers (bagations), boda-boda riders, tuk-tuk drivers
- *Matatu* service workers:
    - Mechanics: routine vehicle services, brakes, tyre menders, welders, panel beaters, spare part dealers
    - Technicians sound engineers, video engineers, painters, lighting specialists, artists, tailors, upholsterers
    - Support workers: petrol station workers, carwash workers, radarmen, night guards, food vendors, mpesa agents

There are many different ways on how to include the stakeholders. Public engagement, otherwise also called Stakeholders Engagement, is necessary to include the opinions and needs of all affected stakeholders (Cascetta & Pagliara, 2013). Cascetta & Pagliara (2013, p. 109) introduce many different tools on how to engage stakeholders in public transport planning, for example, through letters, posters,

via telephone, questionnaires, direct surveys, exhibitions, focus groups, stakeholder conferences, or referendums.

2.7 A conceptual framework

A conceptual framework is used to combine different theories, which are essential to the research question (Ngulube & Mathipa, 2015). This paper combines socio-technical transition theory and stakeholder theory (Figure 6).

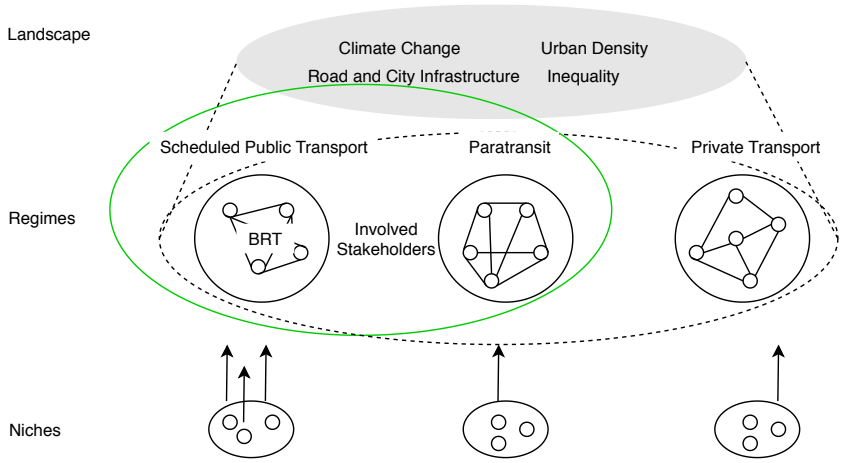

Figure 7. A conceptual framework (inspired by Geels, 2002, p. 261 with minor modifications).

This paper uses socio-technical transition theory with a focus on the Global South to explain the shifts in a regime and the importance of looking at the entire system during such a shift. The conceptual framework will be used to analyze why the focus of transition pathways lies on transformation / transition and not optimization regarding paratransit and BRT. In the next step, this paper looks at the interaction between multi-regimes, in this case, the scheduled public transport and the paratransit regime. Socio-technical barriers are then used to explain the barriers a successful interaction between the scheduled public transport and the paratransit regime. To make the regime shift successful, stakeholder theory is used to describe how the involvement of all stakeholders is necessary to turn the project into a success, as shown in Figure 5.

3 Method

In this part of the thesis, the two methods used – namely, literature review and semi-structured interviews are described. In the next step, the way the collected data is analyzed is introduced. All data has been compiled following certain ethical aspects.

3.1 Research design

The research design is used to ensure that the research questions are answered as completely and accurately as possible (Vaus, 2001). In this paper, an interpretive research design was chosen. An interpretive research design, in contrast to a positivist research design, tries to understand a social phenomenon from the perspective of the subjects involved (Bhattacherjee, 2012).

Therefore, an interpretive research design was selected since the subject matter of this study is shaped by human experiences and should not be taken out of its socio-historic context (Bhattacherjee, 2012). The advantages of an interpretative research design are that the researcher can understand complex processes better (Bhattacherjee, 2012). Limitations are that the research takes more time and resources, as well as that the amount of data collected should neither be too little nor too much. In the former case, false assumptions might occur; in the latter case, the researcher might not be able to interpret the data correctly (Bhattacherjee, 2012).

To collect interpretive data, secondary data were analyzed in the form of a literature review, and interviews were conducted. To counteract the limitations of the interpretive research design, the collection of interpretive data started early, and a selective number of interview partners were chosen to analyze the data as thoroughly as possible.

3.2 Data Collection

Interpretive data were collected via secondary data in the form of a literature review, as well as through primary data by conducting interviews.

3.2.1 Literature review

A literature review is helpful to understand what has been researched before and what the flaws and strengths of this research were (Boote & Beile, 2005). Therefore, secondary sources have to be reviewed (Galvan & Galvan, 2017). In this research, the focus lay on the following secondary sources (Galvan & Galvan, 2017, p. 3): 1. Reports on the empirical research published in academic journals, 2. Theoretical articles and 3. Literature review articles. In order to collect the right information, the following terms were used (Table 3). The sources chosen for this literature review were published between 2000 - 2020 as public transport is a timely research topic and development happens continuously.

Table 3. Search terms in the literature review

BRT systems	Informal Public transport	Paratransit	Informal Economy
Public transport	Sustainability	Informal workers	Green mobility

The terms collected in Table 3 were used to search for articles in databases such as ScienceDirect (Elsevier Journals), accessed via the Uppsala University database. Since the nature of this research is a public transport / urban mobility problem, journals such as *Transport Policy*, *Transport Policy and Planning*, and the *International Journal of Sustainable Transportation* were used.

3.2.2 Case selection

All cases discussed in this thesis are located in SSA, specifically, South Africa, Uganda, Kenya, Ghana, Tanzania, and Nigeria. This choice was made for two reasons. Firstly, the commissioner, Scania, is currently focusing on developing BRT systems in SSA, which led to the choice of the cases. Secondly, conducting research out of Sweden into a different continent brings about many challenges. The selection of interview partners, which primarily are Scania employees, therefore, also plays a role concerning which countries are chosen. Uganda, for example, is currently not developing a BRT system. Still, the author of this paper had established contact with a researcher in Uganda who was able to contribute with data, which led to the inclusion of this country.

3.2.3 Semi-structured interviews

Semi-structured interviews were chosen for this research in order to gather data, which is valid and reliable (Saunders, *et al*., 2016). Semi-structured interviews are one alternative for collecting data using personal interviews. Other ways are structured interviews and unstructured or in-depth interviews (Saunders, *et al*., 2016, p. 374). Semi-structured interviews include both questions with an open-end as well as questions that focus on theory (Galletta, 2013), and the interviewer can adjust or leave out questions depending on the interview conducted (Saunders, *et al*., 2016).

In this research, semi-structured interviews were conducted both with Scania employees, experts in the field, as well as people representing the paratransit workers, such as employees for the unions (Table 4). The line of reasoning was to include as many different stakeholders as possible who are familiar with both the paratransit as well as BRT system. All interview partners but one, Nicolas Camacho, have a direct connection to the African cities chosen. Camacho was included since he had been involved in the development of the BRT system in Bogotá, which serves as an example to many following BRT systems.

The interviews were conducted in English, via Skype, WhatsApp, or Teams, recorded either via Skype or on a mobile phone, and transcribed after the conversation (Appendix A). The transcript was sent to the interviewee after the discussion with a request for validation. All interviewees were asked to sign GDPR forms (Appendix B).

Table 4. Interviewed partners in the project

Name / Position	Organization	Date	Transcript sent	Validation received
Roger Behrens Professor	University of Cape Town	24.02.2020	25.02.2020	11.03.2020
Nicolas Camacho Product Manager	Scania	06.03.2020	19.03.2020	01.04.2020
Nzwana Konco Social Transformation Specialist	FotConsulting	24.03.2020	25.03.2020	31.03.2020
Christopher Kost Director	ITDP	17.04.2020	20.04.2020	
Nicolas Lougovoy Head of Strategic Projects at Scania West Africa	Scania	12.03.2020	12.03.2020	13.03.2020
Fredrik Morsing Managing Director at Scania West Africa	Scania	11.03.2020	12.03.2020	12.03.2020
John Mark Mwanika Program Officer	Amalgamated Transport and General Workers Union	27.02.2020	28.02.2020	01.03.2020
Tamara Nerima Marketing Communication Director at Scania East Africa	Scania	11.03.2020	11.03.2020	19.03.2020
Karl Oskar Sandell Sustainable City Solutions	Scania	12.03.2020	12.03.2020	12.03.2020
Dave Spooner Director	Global Labour Institute	21.02.2020	24.02.2020	24.02.2020
Mark Templeton Sustainability Manager at Scania South Africa	Scania	09.3.2020	09.03.2020	19.03.2020
Eliavera Timoth Marketing Manager at Scania Tanzania	Scania	17.03.2020	17.03.2020	20.03.2020
Cisse Yssoufou General Secretary	UATP Africa	Contact via E-mail	31.03.2020	/

The focus of the interviews conducted with the people presented in Table 4, was to understand more about the interconnection between paratransit and BRT, the interviewee's involvement in the process as well as who the stakeholders in both the BRT and the paratransit regime are. The interviews were divided into two parts (Appendix A). The first part was different depending on who the interviewee was. Here, the focus of the questions laid on the individual's perspective on paratransit and BRT and their personal involvement in either or both of the two regimes. The second part focused on the personal opinion of the interviewee on if or how to integrate paratransit in BRT. The first contact with the interviewees was over Skype, Teams, or WhatsApp. If clarification was needed, some interviewees were then contacted over E-mail.

3.2.4 Data analysis

After gathering the interview data, the next step is the qualitative analysis (Bhattacherjee, 2012). The focus here is to make sense of the data collected so that it can be used in the analysis (Bhattacherjee, 2012). By using thematic coding analysis, data were first transcribed. The transcribed data were then read through, and codes were generated. As a third step, themes were identified based on the literature review (Robson, 2011), and a coding procedure was made using Altas.ti.

3.2.5 Quality assurance

How accurate and adequate scientific research is conducted is based on its "reliability and validity" (Bhattacherjee, 2012, p. 55). Reliability in this context alludes to how consistent the collected data is (Bhattacherjee, 2012). Validity, on the other hand, focuses if the results obtained are in line with the chosen research method (Bhattacherjee, 2012). This research follows the characteristics introduced by Riege (2003) in order to pass the validity and reliability check (Table 5).

Table 5. Ways on how to establish validity and reliability in case studies adapted to interviews and literature review (Riege, 2003, p. 78-79 with minor modifications)

Test of	Characteristics	In this research
Construct validity	Usage of multiple sources of evidence in data collection	Usage of various data sources and interview partners
	Establishment of a chain of evidence in data collection	Transcription of interviews; Documentation of secondary data
	Third-party review of evidence	Validation via follow-up email
Internal validity	Usage of illustrations and diagrams in data analysis to assist explanation	Usage of both tables and figures throughout the paper
	Certainty of systemically related concepts and findings	Analysis of data through the same framework
External validity	Definition of scope and boundaries in research design	Done in 3.3.2 and 3.4
Reliability	Assurance of congruence between the research issues and features on the study design	Done through chapter 3
	Record of observations and actions as concrete as possible	Taping of interviews
	Record of data	Taping of interviews
	Peer review / examination	Constant exchange with supervisor and peer-review throughout the thesis writing time

This research makes use of both a variety of sources, including personal interviews and secondary data. The interviews were always recorded, either via Skype or Quickplay, transcribed, and sent to the interviewees. The interviewees were able to read through the interviews and make adjustments. The interviews and the secondary data were both approached with the same framework, and internal validity was therefore given. External validity of the study was achieved by defining scope and boundaries in

the research design and by matching the data obtained with up-to-date literature. Reliability was achieved by peer review, taping of the interviews, and the detailed tracing of the research.

3.3 Delimitations

Firstly, the direct input of paratransit workers lacks in this thesis, although multiple spokespeople were contacted. While this is a flaw of the research, Dave Spooner, interviewed for a union perspective, shared his research on paratransit workers in Kampala, Uganda, which included quotes with the researcher of this paper. These quotes, therefore, stand for the paratransit workers' perspective. Additionally, this thesis was written during the 2020 Covid-19 outbreak, which made it difficult to gather data, as being interviewed for a thesis project was not prioritized.

Secondly, it is essential to look at this researcher's personal background as a white, Western woman, who grew up in a Western context, writing about socio-technical transitions in an African context. Furthermore, only two of the interview partners were female. Although this researcher tried to include the female perspective as well, most of the researchers and professionals in the field of transportation are men, which is an entirely different problem of the transport industry and would need to be studied in a different context (European Economic and Social Committee, n.d.).

Thirdly, many research papers that are part of the literature review are written by South African researchers and concerning foremost Cape Town and Johannesburg. This selection was made out of two reasons: Firstly, the author of this paper had personal contact with a professor from Cape Town, who is seen as an expert in paratransit / BRT questions. Secondly, there is a lack of literature on this topic in the other countries chosen. When researching the terms "paratransit Africa" in the Uppsala University database, eight of the first 20 articles have a connection to the University of Cape Town.

Fourthly, not addressed in this paper is what happens when passengers are not able to differentiate between the BRT buses and the paratransit buses. Nevertheless, this problem might be solved if an encompassing approach for both BRT and paratransit regime gets introduced. Also, the focus of this paper lies on paratransit as a mode of public transport and not on paratransit, where passengers can decide on the route. The focus is, therefore, on the minibuses and this paper does not explicitly mention other modes of paratransit transport such as motorcycle taxis. Furthermore, the focus lies on how the two regimes, the paratransit and the scheduled public transport regime, interact with each other, once the innovation (BRT) breaks through into the scheduled public transport regime. Not considered are, how the other sub-regimes of scheduled public transport, e.g., metro or subway regime, react to this change.

3.4 Ethical considerations

This paper was written according to the following ethical perspectives: Voluntary participation and harmlessness, disclosure, and ethical obligations to the scientific community (Bhattacherjee, 2012). All interview partners were made aware that participation in this research is voluntary and were given the opportunity to retract their involvement at any point. The researcher of this paper sent the interview guide to participants two days before the interview and disclosed the study objective at the beginning of the interview so that all participants were satisfactorily informed. All interview partners were made aware that the interview was being recorded, and all interviewees were sent a GDPR form, which they could retract from at any given point.

4. Background for the empirical study

This chapter dives deeper into the characteristics of bus rapid transit and paratransit and shows different aspects of each regime. In the next step, the scope is narrowed, and the two regimes are put into the context of African cities. Chapter 4.4 focuses on previous research conducted in the field of BRT and paratransit.

4.1 The scheduled public transport regime (Bus Rapid Transit)

The BRT system is a sub-regime of the scheduled public transport regime. Other parts of the scheduled public transport regime are, for example, trains or a subway regime. The BRT sub-regime (from here on BRT system) has different characteristics, which are shown in Table 6. The service is scheduled and includes higher performance during peak-hours.

Table 6. BRT characteristics according to The Institute for Transportation and Development Policy (2017)

BRT corridor	Part of the road with a dedicated lane for buses. Minimum length: 3km
Dedicated right-of-way	Lanes only for buses so that the buses are not hindered by other traffic (including paratransit)
Off-board fare collection	Fare paid before entering the bus, often via an app or card
Platform-level boarding	The buses are on the same level as the station making it easier for people with a wheelchair or strollers to board
Intersection treatments	Cars are not allowed turns across the bus lane.

The characteristics described above let the BRT buses operate more smoothly and unhindered. Furthermore, BRT systems are often built in less time than a new metro system (Scania, n.d.). The BRT system is mostly divided into its trunk and feeder routes. The central part hereby is the trunk, on which the buses operate unhindered. The feeder service connects the passengers to the trunk hub (itf, 2019) (Figure 8).

Figure 8. Bus Rapid Transit System (Discott, 2014).

The picture above shows the different characteristics of the BRT system. Most of the BRT systems are developed with the plan of covering the entire city, which mostly happens in different phases. Each phase focuses either on corridors or areas in a city, in which the incumbent paratransit operators either have to be incorporated or withdrawn. The first phase of the BRT often focuses on incorporating the incumbent owners and showing the owners, who resisted the integration, how they could gain financially from this solution.

4.2 The paratransit regime

The paratransit regime is part of the informal economy, and it provides income and employment to many otherwise unemployed people (Jimu, 2008). Although paratransit can be found all other the world, it is much more common in the Global South where there is a lack of infrastructure (Cervero & Golub, 2007). The definition of paratransit used in this paper is given by Jennings & Behrens (2017, p. 5):

"Paratransit refers to demand-driven, unscheduled public transport provided by small operators, typically in mini-to-medium-sized buses. Paratransit is sometimes called 'informal,' but operators are not always informal businesses, and they are not necessarily unregulated."

Besides minibuses, paratransit also includes bicycle taxis and motorcycle taxis, and sometimes even horse-carts (Cervero, 2000). This paper primarily focuses on the minibuses and taxis, since these modes of transportation might hinder the success of the BRT by blocking and using the same roads. Although often meaning the same, the names differ from country to country. The minibus *matatu* in Kenya is, for example, called *tros tros*[5] (Figure 7) in Ghana (Khayesi, *et al*., 2015).

Figure 9. A *tros tros* in Ghana (Schlesinger, 2020).

Similar to the *matatu* in Kenya, the *tros tros* in Ghana are often painted in different colors and carry messages via stickers on the vehicles. There are a variety of stickers, usually carrying a political message, cautioning the passengers, or conveying a joke. One of these stickers, for example, displays "sifungue madirisha, ungetaka upepo ungebebwa na boda boda," which translates to "Don't open the windows; if you wanted the breeze you should have used a rickshaw" (Khayesi, *et al.*, 2015, p. 46)

The paratransit operation mostly consists of an owner of a vehicle and its driver (Plano, *et al.*, 2020). The driver is told, which routes to use and which terminals to stop at. The driver gets paid through a "target system," which means that each day the money collected by the driver is split between him and

[5] Tros tros are in other publications called tro tro. This paper follows the spelling of Khayesi, *et al.* (2015).

the owner, where the owner gets most of the income (McCormick, *et al.*, 2016). In some cases, a conductor is also present who is responsible for the passengers and the fare collection (Schalekamp, 2016a)

Advantages of paratransit are that they give jobs to low-skilled workers, provide a connection to the most rural parts, and respond to the needs of the passenger (Cervero & Golub, 2007). Disadvantages, on the other hand, are that they are often not safe, not ecologically friendly, not reliable, and unfriendly to vulnerable groups (Klopp, *et al*., 2019).

4.3 Paratransit and Bus Rapid Transit in Africa

Paratransit is part of public transport in most of the cities in SSA and currently serves 50-98% of the commuters in the countries highlighted in Figure 8 (Jennings & Behrens, 2017, p. 4).

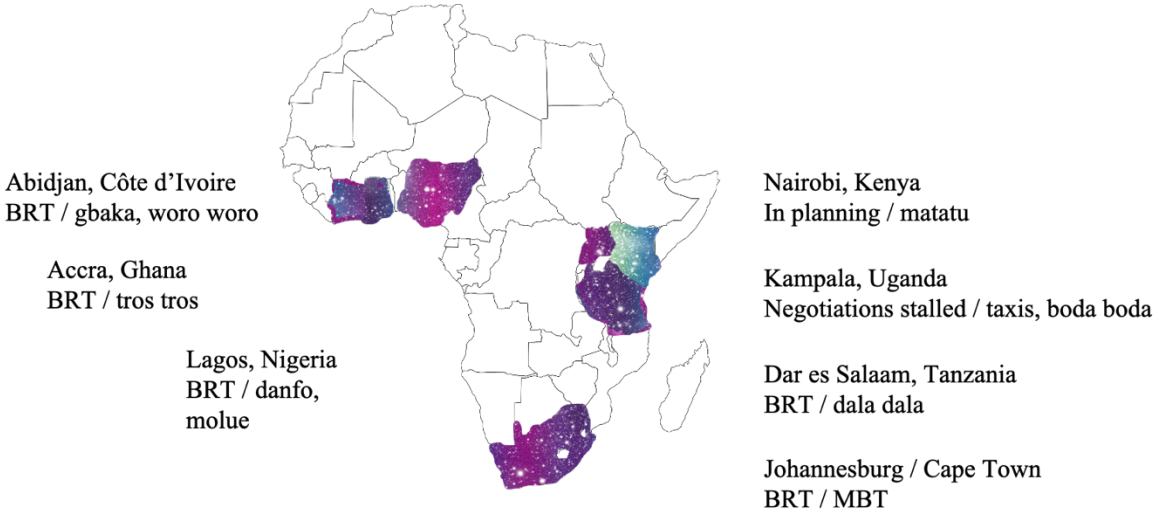

Figure 10. Bus Rapid Transit / Paratransit in Sub-Saharan Africa (Pixabay.com, no attribution required).

This paper focuses on Côte d'Ivoire, Ghana, Kenya, Nigeria, South Africa, Tanzania, and Uganda. The countries are characterized by a growing population, urbanization, and social change (Ehebrecht, *et al.*, 2018). In these countries, the power of the administration is often weak, and there is limited coordination between how the land should be used and how to plan public transport (Nguyen & Pojani, 2018). BRT is, therefore, often introduced as a way of how to optimize the public transport regime (Jennings & Behrens, 2017). Table 7 shows if the cities currently have a BRT system, what kind of paratransit operates in them, if and how these two systems work together, and if the BRT system is subsidized. The question of subsidy is of importance because of two reasons. Firstly, one of the claimed advantages of BRT is that it is not subsidized, while it in many cases is, which raises the "equity question," since paratransit operators are not benefitting from this subsidy (Schalekamp & Klopp, 2018, p. 10). Secondly, if BRT is not subsidized, the fares would be higher, which means that people who are not able to afford the fares will be looking at other modes of transportation (Bruun, *et al.*, 2016).

Table 7. Bus Rapid Transit and Paratransit in African Cities

City, Country	Name, Status of BRT	Form of Paratransit	Current Form	Subsidy
Accra, Ghana	Operating since 2016	Minibus: tros tros (Khayesi, et al., 2015)	Hybrid (pers.com., Morsing, 2020)	Indirectly since the government financed the buses and is currently not charging the operator for using them (pers.com., Morsing, 2020)
Abidjan, Ivory Coast	BRT system in planning (pers.com., Lougovoy, 1, 2020)	Minibus: gbaka, Taxis: woro woro (pers.com., Lougovoy, 1, 2020)	Planned form: Hybrid model (pers.com., Lougovoy, 1, 2020)	Subsidized (pers.com., Lougovoy, 1, 2020)
Nairobi, Kenya	In planning since 2018 (Bizna Reporter, 2018)	Minibus: matatu (Khayesi, et al., 2015)	Public transport almost entirely informal (GLI, 2019)	/
Lagos, Nigeria	Operating since 2008 (Agyemang, 2015)	Minibus: danfo; midibus: molue; taxis: kabu kabu (shared taxis) (Khayesi, et al., 2015; Mobereola, 2009), Motorcycle taxis: okada (Ezeibe, et al., 2017)	Public / private partnership between BRT Lite and the National Union of Road Transport Workers (Jennings & Behrens, 2017)	No subsidy (World Bank, 2016)
Cape Town, South Africa	MyCiTi, Operating since 2011 (MyCiTi, n.d.)	Minibus: MBT (Plano, et al., 2020),	Hybrid Model (Jennings & Behrens, 2017)	The national transport authority provides financial and technical support to cities (ITDP, 2017)
Johannesburg, South Africa	Rea Vaya, operating since 2009 (ReaVaya, n.d.)	Minibus: MBT (Plano, et al., 2020),	Hybrid Model (Jennings & Behrens, 2017)	Subsidized (itf, 2019)
Dar es Salaam, Tanzania	DART since 2016 (Ka'bange, et al., 2014)	Minibus: dala dala (Khayesi, et al., 2015)	Replacement (pers.com., Timoth, 2, 2020)	Subsidized (pers.com., Nerima, 2020)
Kampala, Uganda	Negotiations currently stalled (pers.com., Mwanika, 2020)	Taxis, Motorcycle taxi: boda boda (Khayesi, et al., 2015)	99% Paratransit (pers.com., Mwanika, 2020)	/

The BRT system in Accra is a joint effort by the World Bank, AFD (the French development organization), and Scania together with stakeholders in Ghana (pers.com., Morsing, 2020). The idea here was to involve the *tros tros* in two ways. First of all, the *tros tros* would act as a feeder to the BRT trunk line. Secondly, some of the *tros tros* drivers would be included as drivers in the BRT system. According to Morsing (pers.com., 2020), this system worked quite well, but there might have been too many people involved, and as of now, there are still challenges remaining to implement the BRT system fully. Nevertheless, paratransit owners and the government have been able to work mostly peacefully together (Schalekamp & Behrens, 2010).

Figure 11. A *tros tros* in Ghana (Reichel, 2019).

As of now, the BRT system in Abidjan, Ivory Coast, is in planning, and a design study is about to be conducted (pers.com., Lougovoy, 1, 2020). The plan here is that the *woro woro* will serve as a feeder to the BRT corridor and that the paratransit will be organized in corporations (pers.com., Lougovoy, 1, 2020).

Nairobi, Kenya has been planning a BRT system for the past three years. The development has been met with drawbacks from the union after a report got published that showed the impact of BRT on paratransit workers (itf, 2019). The report "Nairobi Bus Rapid Transit: Labour Impact Assessment" focuses on the paratransit workers, especially on *matatu* workers, their reception of BRT, and how their livelihoods might change once BRT gets introduced (GLI, 2019). The paratransit regime has been subjected to some rules such as the installment and usage of seat belts, and the implementation of licenses (Harvard International Review, 2019)

Figure 12. A matatu in Nairobi, Kenya (pixabay.com, no attribution required).

The BRT system operating in Lagos, Nigeria, is a BRT lite system, meaning that it can be considered a BRT system, which lacks level boarding and continuous exclusive rights-of-way (Schalekamp, *et al.*, 2016b). It was the first one in SSA (Mobereola, 2009). In the beginning, the trade unions organized into companies ran the BRT services with little success and were thus replaced (itf, 2019). Paratransit in Lagos, Nigeria, has many different names, such as *danfo* and *molue* (Figure 11*)*. In 2017, the government released a statement to start removing *danfo* (The Guardian, 2017). As of now, some of the paratransit vehicles can still be found in Lagos (The Dream Africa, 2019).

Figure 13. *Danfo* in Lagos, Nigeria (pexels.com, no attribution required).

The paratransit in South Africa is characterized by its minibus-taxis (**MBT**), which are 15-seater vans (Plano, *et al.*, 2020). In Cape Town, the idea of BRT, called MyCiTi, was introduced in 2007 and the plan was, in the beginning, that it would cover the entire city (Schalekamp, *et al.*, 2016b). In Phase 1, incumbent bus and paratransit owners were supposed to act as the operators, which soon proved to be full of disagreements and opposition (Schalekamp, *et al.*, 2016b). Paratransit would, thus, be used when it is "the most appropriate mode" (Jennings & Behrens, 2017) and MBTs are currently providing unscheduled feeder services to the BRT trunk transferring passengers at the Mitchells Plain Public Transport Interchange (Plano, *et al.*, 2020). The City of Cape Town is also looking into different options of how to provide a well-functioning hybrid system, by, for example, forming a Taxi Operating Company (**TOC**), which would provide feeder services via a contract (Plano, *et al.*, 2020).

In Johannesburg, the BRT system ReaVaya was introduced (Schalekamp, *et al.*, 2016b). Similar to Cape Town, paratransit was supposed to be incorporated from the beginning. The scheduled public transport regime has been subsidized for quite some time, while the paratransit regime has recently received some form of subsidization to upgrade vehicles (Bruun, *et al.*, 2016).

In Dar es Salaam, Tanzania, the BRT system (DART) has been in place since 2016. The system does not cover all the areas, and the *dala dala* operators (Figure 12) are operating there (pers.com., Timoth, 2020). In the future, the goal is to either replace the *dala dala* completely or reorganize them in a more efficient manner (Bruun, *et al.*, 2016). In 2018, DART won the Sustainable Transport Award (Harvard International Review, 2019).

Figure 14. *Dala dala* (pexels.com, no attribution required).

Negotiations regarding a BRT system in Kampala, Uganda, are currently stalled (pers.com., Mwanika, 2020). In Uganda's capital city, the primary mode of transport is unregulated, and the mini-buses are called taxis.

These pictures and descriptions of paratransit in SSA cities show that many of the minibuses are painted in different colors, often displaying a personal message. *Matatus* are also part of popular culture, and named, for example, in songs, or in a figure of speech in which Kenyan leaders are compared to matatus if voters are unhappy with their behavior (Khayesi, *et al.*, 2015). In short, paratransit is part of both the landscape and the culture in SSA, which partly explains the emotional connection many inhabitants have to this mode of transportation.

4.4 Paratransit and Bus Rapid Transit: previous research

Paratransit has been researched by academics, as well as by experts associated with paratransit unions or with public transport planning. With the development of BRT systems, the research started to focus on the future role of paratransit. While there are several papers written on BRT and paratransit in the Latin-American context, this paper primarily focuses on research in the SSA context.

4.4.1 Paratransit and Bus Rapid Transit: different approaches

One of the first research papers on upgrading paratransit is written by Robert Cervero and published in 2000. In his paper, he introduces the four options paratransit has in the future: Acceptance, recognition, prohibition, and regulation (Cervero, 2000, p. 165). Acceptance refers to that paratransit can remain in place without being regulated but also without being upgraded. In recognition, paratransit is legitimized, and the focus lies on safety, insurance rules, and standards. Prohibition means that paratransit is no longer allowed, and drivers and operators are fined or even arrested. Through regulation of paratransit, the city government has to establish an agency only focused on paratransit.

Over the years, new scholars developed different, more in-depth ideas on how paratransit and BRT should cooperate, often based on the research by Cervero. Additionally, federations, such as the International Transport Workers' Federation (**ITF**) together with the Global Labour Institute (**GLI**), and the Institute for Transportation and Development Policy (**ITDP**), have published material on the construction of BRT and thus also on how to move forward with paratransit. The former published "The trade union negotiating guide: Bus Rapid Transit (BRT) and the formalization of informal public transport," and the later the "BRT planning guide." A summary of their ideas can be found in Table 8.

Based on the material published in recent years, Behrens (pers.com., 2, 2020) names the following options on how BRT and paratransit can interact: Acceptance and upgrade of paratransit, acceptance and hybrid form between paratransit and BRT (co-existence of formal and informal public transport)[6], replacement of paratransit with BRT *in toto* (often seeking to incorporate incumbent paratransit into new formal operating companies), and prohibition of paratransit. Acceptance and prohibition are based on the definitions given by Cervero (2000), but the other two options are more in-depth. All options presented here are not exhaustive, and there might be other interaction approaches, which are not mentioned in this paper.

Acceptance and upgrade allude to the point that paratransit has been unjustly criticized and that it might be a safer option than it has been known for, especially if the focus of transport planners is on upgrading this regime (Schalekamp & Behrens, 2010). In this scenario, scheduled public transport and paratransit compete in an unregulated market (Lomme, 2008).

In the *acceptance and hybrid form* approach, BRT and paratransit work side by side, and authorities accept that paratransit will always exist. The definition of Jennings & Behrens (2017, p. 7) is used in this paper "*a hybrid public transport system is one where formal and informal[7] systems co-exist. This co-existence is referred to as 'complementary' (or as exhibiting 'operational complementarity') when*

[6] In this paper, the terms formal and informal are replaced by scheduled and paratransit. This approach, therefore, is co-existence of scheduled public transport regime and paratransit regime from hereon.
[7] Again: Where scheduled and paratransit co-exists.

each service has an identified and integrative role in the system." One hope is that the introduction of BRT would automatically upgrade the paratransit regime as well (Klopp & Cavoli, 2019). The hybrid form can be implemented by moving step by step and engaging all stakeholders, as well as by giving them the option to exit the implementation if necessary (Browning, 2001).

There are different ways on how to achieve a hybrid model, in which paratransit is part of the BRT network. Paratransit and BRT can work together in the following ways: connecting corridors, intra-corridor arrangements, and feeder-trunk schemes (Behrens, *et al.*, 2016). In the first arrangement, corridors are put in place on which either paratransit or scheduled public transport operators can operate, connect and exchange passengers. In the second arrangement, the intra-corridor one, paratransit and scheduled public transport can interact in the following ways: parallel route services, shared-right-of-way, shared busway, and peak-lopping. These approaches are either seen as provisional approaches (connecting corridors), or as "destructive competition" (parallel / shared routes) (Behrens, *et al.*, 2016, p. 239). For more information on these arrangements, the following paper is advised: *International case studies of hybrid public transport system regulation and complementarity* by Behrens, *et al.* (2016). The most discussed hybrid approach, which is also in the focus of this paper, is the feeder-trunk solution that could play out in the following ways: open market (see *competition*), area licensing / route licensing, concessioning or franchising, and contracting (Ferro, *et al.,* 2012; Jennings & Behrens, 2017). This next part is structured in the following way. It will firstly show how paratransit has to change to become a feeder-trunks service. Then it will focus on the advantages and disadvantages of feeder – trunk schemes. In the next step, different ways of how to implement feeder-trunk will be introduced. Lastly, the focus is on the question of how a feeder-trunk scheme works since paratransit is unscheduled.

Once BRT is introduced, and the interaction approach decided on is a feeder-trunk scheme, paratransit has to undergo significant changes (Ferro & Behrens, 2015). Behrens, *et al.* (2016) divide the regulatory approaches into two main categories. Firstly, regulatory frameworks, which do not need to fundamentally change paratransit (e.g., *licensing*). Secondly, "corporatization and formalization," which changes paratransit profoundly and which might lead to paratransit no longer falling strictly into the definition of being paratransit (e.g., *concessioning, franchising*) (Behrens, *et al.*, 2016, p. 231). In the following, different feeder-trunk schemes are introduced and analyzed how paratransit has to change in each option. In the latter case, paratransit has to change its daily operating models ("e.g., daily income, relatively informal labor relations, limited vehicle maintenance") and move to a more "structured type of contract (e.g., "gross cost contracting, labor and social responsibilities to employees, mandated capital investments in fleets") (Ferro & Behrens, 2015, p. 126). These improvements should be supported by the city authority and make both the driving and the vehicle safer (Behrens, *et al.*, 2018).

In *licensing*, paratransit is awarded a license that allows them to operate either on routes or areas to and from the BRT trunk (Figure 13). These areas are often neighborhoods in which the BRT buses are not able to work, and the entire span of the public transport regime is, thus, much bigger (Ferro, et al., 2012). In licensing, paratransit does not have to be fundamentally changed (Behrens, *et al.*, 2016).

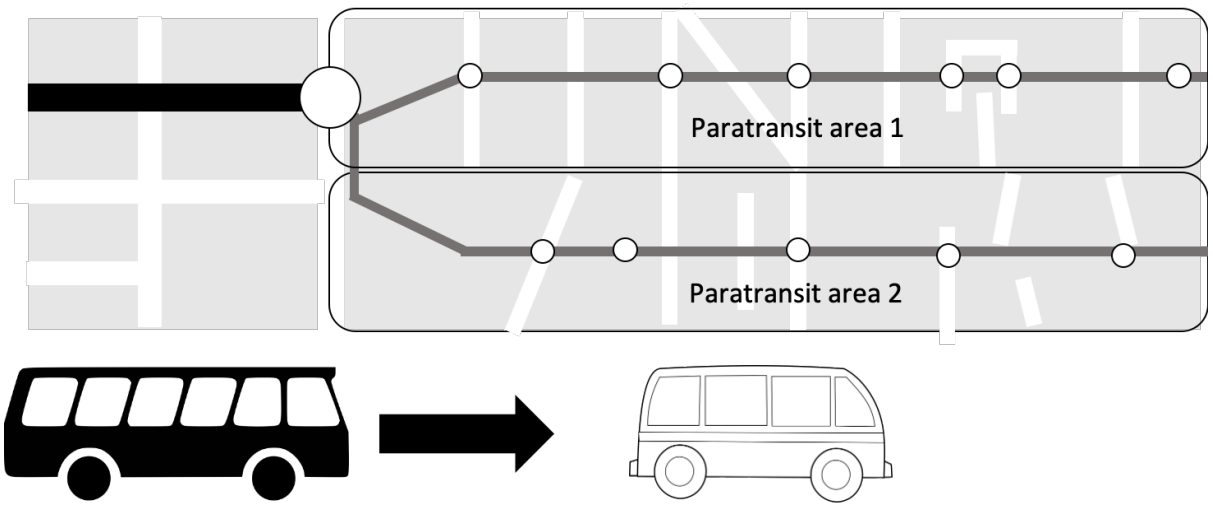

Figure 15. Feeder-trunk scheme (area licensing) (based on Ferro, *et al.,* 2012, p.611, with minor modifications).

Figure 13 shows how the BRT operates the trunk hub, while paratransit acts as a feeder and caters towards paratransit areas one and two. Passengers switch from BRT to paratransit and vice versa.

Concessioning and *franchising* require more corporatization and formalization than the regulatory approaches described above, and paratransit operates exclusively during a set time (Behrens, *et al.*, 2016). The difference here is that in *concessioning* all commercial responsibility falls onto the paratransit operator, and the regulating authority only poses some basic requirements such as vehicle maintenance (Behrens, *et al.*, 2016). In *franchising*, the regulating authority is more involved and might need to take the commercial risk as well (Behrens, *et al*., 2016). Paratransit operators, therefore, are important stakeholders in the development process and develop fixed agreements with scheduled public transport (Plano, *et al.*, 2020).

Contracting is the most corporate and formalized hybrid approach. "Competitively tendered contracts" are awarded to paratransit operators (Behrens, *et al.*, 2016, p. 237). Depending on which contract is chosen, either the operator bears all commercial risk ("net cost contracts") or the contracting authority does ("gross cost contracts") (Behrens, *et al.*, 2016).

In a hybrid approach, most of the feeder services operate unscheduled, while the trunk operates scheduled (Behrens, *et al*., 2017). If the feeder services operate unscheduled, the number of passengers being delivered to and from the trunk might be unbalanced Secondly, if the driver of the paratransit receives the trip to be uneconomical, they might not operate, which leads to a prolonged waiting time for customers and a spotty service (Behrens, *et al.,* 2017). Behrens, *et al.* argue that for unscheduled feeder-trunk services to function, there is the need for some sort of public intervention to incentivize the operators (2017). In Cape Town, for example, the public transport system consists of scheduled trunk services and unscheduled paratransit feeder services (Behrens, *et al.,* 2018). Plano, *et al.* have been researching incentives for MBTs to operate during unfavorable hours. One option would be that paratransit drivers can charge higher fares in the evening so that the feeder-trunk operation works more smoothly (Plano, *et al.*, 2020, p. 280). Another financial factor mentioned is that passengers pay a small fee when they transfer from the trunk to the paratransit during off-peak hours (Plano, *et al.*, 2020, p. 280). These interventions have not yet been tested in practice.

Feeder-trunk schemes have their advantages and disadvantages. One common argument against a feeder-trunk scheme is that paratransit business operators would resist because profit to be made would be less (Bruun, *et al.*, 2016). A case study in Cape Town researched that MBT operators showed the opposite and concluded that feeder-distribution schemes would be more profitable (Del Mistro & Behrens, 2015). Nevertheless, this improved system would also result in job loss as fewer MBTs are needed. The authors conclude that if a feeder-trunk scheme is installed, it is crucial to focus on the

paratransit workforce who were not absorbed by the development (Del Mistro & Behrens, 2015). Behrens, *et al.* (2016) also offer three lessons learned regarding feeder-trunk solutions. Firstly, whatever option is chosen has to be reviewed continuously. Secondly, any change in the public transport system affects both operators as well as passengers and has to be implemented with great care. Thirdly, no matter what the intentions, a hybrid network always comes with its tradeoffs. Without corporatization, paratransit might be in the way of BRT, with too much corporatization, paratransit loses its flexibility (Behrens, *et al.*, 2016).

Prohibition of paratransit can lead to problems. In Nigeria for example, when *okada* activities were banned, criminal activity increased (Ezeibe, *et al.*, 2017). The prohibition approach is, generally, not in the focus of academic research as the consensus is that even if paratransit is forbidden, it will continue to exist (Ferro, et al., 2012).

Replacement of paratransit with BRT refers to a "comprehensive, corridor-by-corridor implementation of BRT" (Jennings & Behrens, 2017, p. 11). The idea of BRT is that it will slowly but surely face out paratransit operators. Paratransit will be organized in new corporations, and then, step by step, be fully integrated into BRT. Often, BRT developers hope that once the corridors are put in place, only the formalized system exists, and paratransit disappears (Jennings & Behrens, 2017).

Ferro, *et al.* also argue that the *in toto* replacement of paratransit brings about two outcomes: the *in toto* replacement will take an extensive amount of time, since the negotiations with the incumbent operators will prove difficult or that the replacement will never happen (Ferro, *et al.*, 2013, p. 121). Cases in many cities show that paratransit persists (Ferro, et al., 2012). Reasons for this are, firstly, that the paratransit operators have resisted being wholly replaced. Secondly, it has proven that many cities do not have the institutional and financial capacity to build a complete BRT system that reaches the entire town, meaning that there is always a spot left open for paratransit operators (Jennings & Behrens, 2017). One of the examples here is the MyCiti BRT system in Cape Town, in which the MBTs were first supposed to be replaced entirely, but after stalled negotiations and thus rising expenses, it was decided that the MBTs should function as a feeder service to the trunk in a hybrid system (Plano, *et al.*, 2020). The approach followed there has, therefore, moved away from a "displace and replace" approach to an "embrace, engage, improve, and integrate" one (Schalekamp & Klopp, 2018, p. 10).

The understanding of the ITDP suggestion on how to move forward is clustered as a replacement approach as it fits the definition previously given. While ITDP also favors a feeder-trunk service, it argues that the entire operation is managed by one hand: "*In the best systems, the BRT system operator operates both trunk services and feeder services under professional quality of service contracts with private vehicle operating companies. Such feeder services are not operated by informal operators, but by modern companies, and they form an integral part of the BRT system, with consistent branding, fare systems, information technology, and other BRT amenities*" (ITDP, 2017, p. 172).

The Global Labour Institute argues that this suggests that paratransit is not able to be formalized themselves, but only via newly installed companies (itf, 2019). They call for the inclusion and formalization of paratransit, instead of "contracting it out to external companies" (itf, 2019, p. 22).

Nevertheless, the ITDP also states that many BRT projects have focused on reorganizing the existing paratransit operators into new roles in the BRT system, "such as shareholders in the consortia or companies running the BRT services" (ITDP, 2017, p. 522). The ITDP argues that the way paratransit is included is critical. Paratransit should be included so that they do not resist the development but also not given too much power (ITDP, 2017). The transition pathway the ITDP sees as most successful is when "BRT operating companies are formed primarily out of the old informal owners and their staff, but in partnership with other vehicle operating companies that have the investment and skills needed" (ITDP, 2017, p. 522). Additionally, the BRT system design team has to assess which routes are impacted by BRT development. Many BRT systems "canceled numerous bus or minibus routes and their licenses and replaced these services with the new BRT services" (ITDP, 2017, p. 525). The

question which arises here is how paratransit operators and drivers assess this approach and if this leads to the integration of all paratransit operators.

Table 8. Approaches of Academics / Union / Institute for Transportation and Development Policy

	Academics	**Unions (ITF / GLI)**	**Institute for Transportation and Development Policy (ITDP)**
Preferred approach	Hybrid (Ferro, *et al.*, 2013, p. 121; Graeff, 2009; Jennings & Behrens, 2017, p. 8; Nguyen & Pojani, 2018; Schalekamp & McLachlan, 2016) "Feeder-trunk-distributor services offer particular promise for complementary hybrid public transport systems, and the successful incorporation of paratransit incumbents. In such a system, different operators within the public transport network use appropriately sized vehicles to provide different services" (Jennings & Behrens, 2017, p. 10)	Hybrid (itf, 2019) "Investment for the transition of current informal services into a formalized, effective and efficient system, rather than contracting out to external companies" (itf, 2019, p. 37)	Replacement "In the best systems, the BRT system operator operates both trunk services and feeder services under professional quality of service contracts with private vehicle operating companies. Such feeder services are not operated by informal operators, but by modern companies, and they form an integral part of the BRT system, with consistent branding, fare systems, information technology, and other BRT amenities." (ITDP, 2017, p. 172).
BRT Subsidy	/	Pro subsidy (itf, 2019, p. 18)	Best case scenario: not subsidized (ITDP, 2017, p. 139)

Table 8 shows that both academics and the unions are leaning towards a hybrid approach between paratransit and BRT. The information on how academics stand on subsidizing BRT was not able to be found, the unions and the ITDP disagree on this. The union's stance is strongly pro-subsidy, whereas the ITDP believes that one of the strengths of BRT is that it can operate without being subsidized. Concerning the paratransit regime, "the industry has for a number of years been calling for subsidization" (Del Mistro & Behrens, 2015, p. 273).

4.4.2 Enabling factors

Cervero (2000, p. 163) describes different enabling strategies: (1) management and organizational options; (2) regulatory reforms; (3) financial initiatives; (4) infrastructure improvements; (5) training; and (6) demonstration programs. This paper also adds (7) technology. The following enabling strategies will be looked at more closely, except for (2), which has been discussed in 4.4.1, and (6), which is considered not relevant to the following discussion. Although Cervero's categorizations solely target the improvement of paratransit, it can also be used as enabling factors for better interaction between paratransit and scheduled public transport (BRT).

Although paratransit operators are mostly self-regulated, there are some (1) *management and organizational options*, which can lead to an upgrade of paratransit. (Cervero, 2000, p. 163). From a political perspective, governments can enforce safety standards more substantial (change of tires every second year). Otherwise, the combat of corruption should be a top priority, as many politicians gain from the paratransit regime. The problem here is that corruption enables paratransit to operate while at the same time hindering a legitimization of them. On an organizational level, paratransit operators can voluntarily form cooperatives (Behrens, *et al.*, 2017). This has been proven to be quite successful in Kenya, where the *matatu* businesses formed "Savings and Credit Cooperatives" (**SACCOs**), which improved paratransit operations. This development was feasible through paying the drivers a salary, "systematic vehicle monitoring and compulsory vehicle depreciation costing" (Behrens, *et al.*, 2017, p. 97).

One possibility on how to upgrade paratransit and thus improve the public transport system is to give owners of paratransit (3) *financial incentives* to obtain better vehicles, improve their driving behavior and passenger comfort (Schalekamp & Klopp, 2018). Cervero names two *financial initiatives*, namely "credit access and financial incentives" (Cervero, 2000, p. 166). Credit access could lead to an improvement of the vehicles and thus the paratransit regime. Financial incentives, such as "lower registration fees, excise tax exemptions on vehicle purchases, and low-interest loans," could achieve the same outcome.

(4) Infrastructure improvements are the improvement of terminals and staging zones as well as dedicated lanes for paratransit vehicles (Cervero, 2000, p. 168).

Other enabling strategies to improve paratransit operations are (5) *trainings and education* about "traffic rules, safe driving practices, and vehicle maintenance (Cervero, 2000, p. 170). Furthermore, many of the drivers are unable to read, which poses a huge barrier for a successful interaction between paratransit and BRT. Trainings can also include "customer relations and conflict resolution" (Cervero, 2000, p. 170). In 2013, for example, a young woman was pushed out of a *matatu* because she was not able to pay the demanded fare. The woman fell and got run over by an approaching *matatu* (Khayesi, *et al.*, 2015, p. 81).

One of the (7) *technological enabling strategies* which has been in focus recently is cashless fare collection (**CFC**), which will eventually make it easier to include paratransit as a feeder to BRT (Tinka & Behrens, 2019). There are different CFC systems such as an SMS service, a credit card billing based technology, contactless CFC card, or one linked to mobile based technology (Schalekamp, *et al.*, 2017). The CFC initiatives regarding the cities researched in this paper are Kenya (BebaPay, Abiria Card: no longer in use), Nigeria (Max Go: in operation), South Africa (Tap-i-Fare: no longer in use), Tanzania (UberPOA: in operation), and Uganda (Uber: in operation) (Tinka & Behrens, 2019, p. 3). The authors conclude that while the interest is high, many of the projects have not been successful. The reasons for this are that the stakeholders follow different interests and a lack of coordination (Tinka & Behrens, 2019, p. 10).
.

5. Results

The following section focuses on the empirical findings from the interviews. (The structure and key questions are presented in Appendix A). This part follows part two of the interview guide and first tackles the question if paratransit should be optimized or if BRT should be introduced. Then it focuses on which approaches there are for a successful interaction between BRT and paratransit. Lastly, socio-technical barriers are used to describe the barriers the interaction between BRT and paratransit is facing.

5.1 Optimization of paratransit vs. introduction of Bus Rapid Transit

In Sub-Saharan cities like Kampala, Uganda, paratransit accounts for 99% of the public transport (pers.com., Mwanika, 2020). This poses the question if the development of the BRT is necessary, or if instead the money and effort could have been put on the optimization of paratransit, to make it as safe, efficient, and reliable as a BRT could be.

The development of a new BRT system has been favored by most of the interview partners, mainly for the reasons that BRT is "*the most sustainable option*" (pers.com., Nerima, 2020), that it addresses challenges in today's public transport system such as "*congestion, traffic jams, pollution, offering more formal employment*" (pers.com., Mwanika, 2020), and that it simply "*is the better solution*" (pers.com., Templeton, 2020). Also mentioned are the benefits BRT brings to developing cities such as "*efficiency and increase in revenue*" (pers.com., Timoth, 1, 2020). In South Africa, for example, before BRT, a trip into town would take around three to four hours, now commuters are in town within less than an hour (pers.com., Konco, 2020). Nevertheless, it was also mentioned that the development of BRT is not an either / or question, but that BRT should act as a base to other transport solutions (pers.com., Lougovoy, 1, 2020). By developing a BRT system, the idea is that it should not be a competition between the systems, but an "*efficient combination of all of them*" (pers.com., Lougovoy, 1, 2020).

Furthermore, the decision of BRT or optimization is "*highly context-dependent*," as it depends on the influence of the authorities and the capacity of the city (pers.com., Behrens, 1, 2020; pers.com., Morsing, 2020). Especially in cities with a high volume of passengers, the development of BRT should be pursued (pers.com., Behrens, 1, 2020), since the "*informal sector will never be enough*" (pers.com., Morsing, 2020). Only one interview partner said that it should be an option to look at optimizing the already existing public transport solutions since the paratransit sector is *"very important"* (pers.com., Sandell, 2020). The taxi drivers interviewed by Spooner (pers.com., 2) in Kampala, Uganda, responded with 43% in favor of BRT, 48% against, and 9% undecided (88 responses).

5.2 Paratransit and Bus Rapid Transit: four approaches

BRT has already been introduced in five of the cities analyzed in this paper, in the three other cities, negotiations are currently taking place. Therefore, in a next step, it is essential to find out what the different approaches are on how to interact with paratransit. Four different options, accumulated via the literature review and personal contact with Behrens, were given to the interviewees with the request to add other approaches to the list. No interview partner chose option 5.2.1 and 5.2.4. Nevertheless, to make the different approaches as encompassing as possible, they are listed below. One interview partner did not feel comfortable with being put in any of these categories. His approach is therefore listed separately under chapter 5.3.5.

5.2.1 Acceptance and Competition

The complete acceptance of paratransit and thus a free, competitive market, was not addressed by any of the interview partners.

5.2.2 Hybrid Form

The hybrid form approach was mentioned by many of the interview partners as the way forward. The idea here is that paratransit and BRT would play a *"complementary role"* (pers.com., Lougovoy, 1, 2020; pers.com., Mwanika, 2020). This role could be that paratransit operates on the last / first mile and then feeds the trunk line, the BRT, with passengers (pers.com., Camacho, 1, 2020; pers.com., Mwanika, 2020). For this to be successful, BRT would operate as the trunk, prohibiting the *"informal sector on that particular line to get this efficient stream of passengers,"* but seeing the entire system and not excluding *"other solutions"* (pers.com., Morsing, 2020). Another factor of why paratransit should operate as a feeder is that the suburbs or small streets in different neighborhoods are not made for BRT buses, and paratransit would, therefore, be essential to connect the passengers to the main BRT hubs (pers.com., Lougovoy, 1, 2020; pers.com., Nerima, 2020). This solution could also *"ease congestion in the cities rapidly"* (pers.com., Sandell, 2020) and outcompete the usage of cars (pers.com., Camacho, 1, 2020). Furthermore, it is mentioned that once BRT gets introduced, paratransit would also upgrade, and it would lead to optimization and update of the ecosystem as it is today (pers.com., Sandell, 2020). Scania employee Lougovoy is currently involved in the development of a BRT system in Abidjan and also focuses on the inclusion of the paratransit, the *gbaka* and *woro woro*, there. He imagines that the paratransit should serve as a feeder to the BRT trunk. To achieve this, paratransit has to be reorganized into formal corporations to get a license from the public transport authority (pers.com., Lougovoy, 1, 2020). This notion of regulating paratransit was also stressed by Camacho (pers.com., 2, 2020).

As a positive example of hybridity, Johannesburg and Cape Town are mentioned. Historically, the MBTs in Cape Town serve as the feeder to and from the railway station (pers.com., Behrens, 1, 2020). In 2007, the National Department of Transport Policy introduced the idea of replacing all of the MBT associations. The authorities in Cape Town recognized quite soon that this was not going to be feasible. The current state, therefore, is that a hybrid network is installed in Cape Town (pers.com., Behrens, 1, 2020). Templeton agrees and sees this as *"really successfully"* (pers.com., Templeton, 2020). Behrens also mentions that MBTs in Mitchells Plain, an area in Cape Town, decided to voluntarily establish themselves as the 7th Avenue Taxi Association, contracted to provide scheduled services, which led to many improvements both in the efficiency of the service as well as customer satisfaction. How and if this success can be replicated, remains to be further researched (pers.com., Behrens, 1, 2020).

In a follow-up question, the interviewees were asked how a hybrid approach could look like in practice. Behrens (pers.com., 1, 2020) answers that *"area licensing is going to be something important for us to consider."* Nevertheless, Behrens mentions that as of now, it remains unsolved what the best hybridity approach is. Camacho (pers.com., 1, 2020) states that *"most of the BRT systems now work with concessioning or licensing."*. Spooner (pers.com., 1, 2020) answers that *"area licensing and route licensing is the way to do it."*

5.2.3 Replacement of paratransit

Timoth (pers.com., 2, 2020), who works for Scania in Tanzania, states that the ultimate goal of BRT is to completely replace the *dala dala* since BRT is "*faster and reliable, cheaper, reduces congestion, and gives room for fresh air in the city*."

Disadvantages of the replacement of paratransit were also mentioned in multiple interviews. For one, *"paratransit is still going to be there, and BRT is never going to cover the entire needs of a city"* (pers.com., Spooner, 1, 2020). Another interviewee mentions that *"the BRT will come, but it will serve not even 40% (of the city)"* (pers.com., Morsing, 2020). Furthermore, paratransit is a significant segment of the economy in many African cities and, e.g., Templeton (pers.com., 2020) does not *"see the government taking any affirmed political stand against that segment in the next five to ten years*." Camacho (pers.com, 2, 2020) also mentions that a *"full scale implementation of a BRT that could go to all parts of the city would be too expensive and loose its competitive angle with other kinds of transport systems."*

5.2.4 Prohibition

None of the interview partners addressed the prohibition approach as a way forward. Morsing mentions that "if you have a trunk BRT line going from one place to another you might need prohibition of the informal sector on that particular line" (per.com., Morsing, 2020). Besides that, complete prohibition of paratransit is not mentioned by any of the interview partners.

5.2.5 No Category

Christopher Kost (pers.com., 2020), director of ITDP Africa, argues that the categories given where too *"black and white."* He is favoring an *"end to end"* journey for the customer, which is modern, reliable, and efficient and *"one system."* Kost does not believe that making the *matatu* drivers part of the feeder system is *"politically viable."* Working as feeders will be much less profitable than working the trunk line. Instead, he argues that the best way is *"retaining most of the existing paratransit routes and just having them come into the BRT system where the BRT lanes are available."* In other words, this would format itself as *"keeping the root structure; It is the same service that is operating, but they'll (paratransit) be using the BRT infrastructure when they get onto the main line."* This means that in some cases, the *"same bus operators are operating the BRT service and regular service."* Kost also argues that the paratransit workforce is interested in working with the BRT design team since *"everyone's clear that there's a need for this (the current transport system) to change."* However, he says that *"there's certainly more work to be done in making the workforce an equal part of these negotiations."*

5.2.6 Move forward

No matter if it comes to a hybrid form with BRT or the replacement of paratransit, there are different ways on how to achieve a successful outcome. When asked on how to achieve that, one of the answers is a *"stepped implementation,"* meaning that paratransit would gradually be included in BRT.

"So, it is a stepped implementation in which these guys feel invited to be part of the solution and also with the society, with the city, so that they see the added value and not a forced solution for them" (pers.com., Camacho, 1, 2020). Behrens agrees and says "an incremental improvement over time is probably the best way to get a BRT type service in the longer term than the kind of big bang that will change everything in the corridor in one go" (pers.com., 1, 2020).

5.3 Human actors

The factor, which makes the public transport system successful, mentioned by nearly all interview partners was the **early and strong inclusion of the paratransit industry** (pers.com., Behrens, 1, 2020; pers.com., Lougovoy, 1, 2020; pers.com., Spooner, 1, 2020; pers.com., Templeton, 2020). It is mentioned that *"everything is irrelevant"* if the informal workforce is not included from the beginning (pers.com., Mwanika, 2020; pers.com., Spooner, 1, 2020). Problematically, authorities are often scared of them (pers.com., Spooner, 1, 2020). Spooner (pers.com., 1, 2020) describes the scenario in Kampala, Uganda, where the authorities do not go into conversation with the paratransit workforce without bringing police as a backup. This behavior towards them has to change, and the paratransit workforce has to be seen as people *"who want to make a living"* (pers.com., Spooner, 1, 2020).

There are different ways on how to engage the paratransit workforce more vigorously. One way on how to achieve this is to have *"engagement and discussion"* starting early. Another to include the paratransit workers by training the drivers (pers.com., Lougovoy, 1, 2020; pers.com., Morsing, 2020). In Ghana, for example, the main idea was "*to take the tros tros drivers and train them to drive the big buses"* (pers.com., Morsing, 2020). Although the success of paratransit cooperatives cannot stand for all African cities, Behrens (pers.com., 1, 2020) mentions that cooperatives have also proven quite successful in Kenya. Cooperatives are well known to the population, so the *matatu* ones were able to *"collectively manage vehicles, move drivers onto salaries, some were able to get cashless fare*

collection systems going." In the end, the Ministry of Transport in Kenya *"determined that all matatu operators anywhere in the cities needed to be members of a cooperative."*

When it comes to the inclusion of the workforce, it is also essential to talk to everyone, especially the paratransit drivers. Often only the paratransit owners are included in the conversation, who are pursuing different goals than the drivers hired by them (pers.com., Behrens, 1, 2020; pers.com., Spooner, 1, 2020). The same stance can also be heard from the taxi drivers in Uganda, interviewed by Spooner (pers.com., 2, 2020) who have pointed out that they haven't been consulted in novel governmental developments, *"which is a problem."* Furthermore, the lack of consultation and involvement in the planning was mentioned as one of the reasons for paratransit drivers in Kampala for opposing the BRT system (pers.com., Spooner, 1, 2020). This can also be seen in the case of South Africa, where the informal sector was not included in the negotiations. *"The drivers were pretty much ignored completely in the negotiations around the formation of operating companies to provide BRT services."* However, they *"are absolutely essential to any attempt to try and modify the quality of service"* (pers.com., Behrens, 1, 2020).

Lougovoy (pers.com., 1, 2020) also states that discussions with paratransit drivers will be difficult, because they *"are usually not educated, sometimes they don't even have a traffic license, they have a very bad reputation."* Spooner (pers.com., 1, 2020) also recalls that many people in the paratransit workforce are seen as *"gangsters,"* which is an unfair description since they are *"people like you and me."*

When asked if the **inclusion of women** could also be a success factor, different answers were given. One interview partner mentions a feeling, or something that they had *"heard locally"* that women *"perform better in terms of sticking to the rules that the drivers are obliged to follow"* (pers.com., Behrens, 1, 2020) and that the service the women are offering is *"efficient, affordable, and clean"* (pers.com., Mwanika, 2020). Spooner (pers.com., 1, 2020) replies that *"authorities would agree that it would be an extremely good idea to increase the number of women,"* but for that to be successful, the *"attitudes of men"* had to be challenged. Mwanika (pers.com., 2020) says that there are many women who would like to become drivers as well, as these jobs *"offer a bigger financial reward,"* but that it is hard for them to breakthrough since the *"current system is male-dominated."*

One possibility of how to include more women is that they need to be included in the leadership structure, but also to organize the women themselves so that they can apply to loans and build up their own cooperatives (pers.com., Mwanika, 2020). One practical example was also conducted in Ghana, where Scania held a dedicated training for women-only to which over 450 people applied (pers.com., Morsing, 2020). This was seen as a prime example, and other truck companies followed (pers.com., Morsing, 2020). Lougovoy (pers.com., 1, 2020) also states that the BRT system in Abidjan will try to attract women.

5.4 Barriers

Multi-regime interactions have different barriers to overcome so that the regimes can interact successfully with each other. In 5.4.1 – 5.4.4, the technological, political, socio-cultural, and economic barriers are clustered. It should be noted that the barriers can fall into multiple categories at the same time.

5.4.1 Technological barriers

The first factor mentioned was that public transport should be seen as a **whole system** instead of multiple, individual solutions (pers.com., Camacho, 1, 2020; pers.com., Morsing, 2020; pers.com., Spooner, 1, 2020). In the end, the most important thing is that *"the system is working together,"* and this system might have elements of *"buses, ferry boats, or tros tros"* since the *"transport system will not perform better than its weakest link"* (pers.com., Morsing, 2020).

In relation to this, multiple interview partners mention that no matter how the public transport system is built in the end, it has to be a better option than taking the car (pers.com., Camacho, 1, 2020; pers.com., Konco, 2020; pers.com., Mwanika, 2020; pers.com., Nerima, 2020). As Morsing (pers.com., 2020) says, *"you need a more efficient system because otherwise you also have a very strong development of the use of private cars, which is not the solution either."*

Another factor mentioned that could lead to successful inclusion of paratransit in BRT is if the **stations are designed** with *"the involvement of the workers in the paratransit industry"* (pers.com., Spooner, 1, 2020). Spooner states that as of now, BRT stations often seem like they were designed *"to have the minimum number of people around on its stations."* In many African cities, though, informal workers also work as *"porters and loaders"* at paratransit stations to help the people and receive a little tip. Therefore, how the stations and the terminals are designed *"becomes extremely important"* (pers.com., Spooner, 1, 2020).

Additionally, Morsing (pers.com., 2020) mentions that in Ghana, paratransit often uses the BRT infrastructure and park the tros tros at BRT bus stops. If this is the case, the flow system of the BRT is hindered, and the *"public transport alternative is not really attractive anymore"* (pers.com., Morsing, 2020). Lougovoy (pers.com., 1, 2020), therefore, states that a *"parking station for feeding buses next to the BRT buses"* is essential.

Spooner (pers.com., 1, 2020) also focuses on the number **of staff on a bus**, which is incremental to make the joint effort from BRT and paratransit a success. For him, *"it would make a huge difference if you have not just a driver, but you have another staff member on board, a conductor, people to help people"* so that pickpockets can be chased away and the system can be made more secure.

5.4.2 Political barriers

Another enabling factor mentioned was the **use of incentives** instead of *"contractual obligations"* (pers.com., Behrens, 1, 2020). Morsing (pers.com., 2020) adds on to this by saying that in his experience, trying to *"regulate the informal sector is very difficult*."

"Some kind of operating deficits payment in the evening if they aren't able to cover the operating costs or some kind of financial incentive to encourage them to provide the service that is needed to improve the complementarity with the other modes in a hybrid system" (pers.com., Behrens, 1, 2020).

Behrens (pers.com., 1, 2020) gave one example of Durban, South Africa, where tracking devices were installed in the MBTs, which measured how the drivers operated in regard to speed and other factors of unsafe driving. Drivers who operated safely then received a financial bonus. Behrens believes that *"improvements occurring at scale"* are going to be easier if the *"interventions are first voluntary."* Lougovoy (pers.com., 1, 2020) agrees and adds that it needs to be *"both incentives and regulations."* Incentives, in this case, could be training for the drivers and an integrated ticketing system.

Morsing (pers.com., 2020) also argues that some laws and regulations have to be implemented more harshly. Morsing recalls the current situation in Ghana, where paratransit drivers have to go to a technical inspection once a year, where traffic police control the streets, but where the rules are still not followed. If these rules and regulations are not implemented, the informal sector is *"disturbing the well-functioning BRT by using their infrastructure"* (pers.com., Morsing, 2020).

Another factor, which influences the successful interaction of paratransit with BRT is **politics**. *"Politics is the thing that makes or breaks BRT"* (pers.com., Spooner, 1, 2020). The paratransit sector has connections to different governmental departments. In Kenya, for example, one of the reasons why the development of BRT has been standing still is the influence of cartels (pers.com., Nerima, 2020). People who are *"police, parliamentarians, and civil servants"* are involved in the business and are *"making money from it"* (pers.com., Spooner, 1, 2020). This can also be heard from taxi drivers in Kampala, Uganda interviewed by Spooner (pers.com., 2, 2020):

“We don’t have independence and freedom to work because the police mistreat us, because you tell them that I have already issued a fine to pay but they still give you another just on the same day, same hour over the same case.”

This means that every decision related to paratransit also affects the stake politicians and police have in it, and it *“is not in their interest maybe to see BRT clear out the paratransit industry”* (pers.com., Spooner, 1, 2020). **Corruption**, therefore, has to be tackled first if a successful system is the goal (pers.com., Lougovoy, 1, 2020; pers.com., Morsing, 2020; pers.com., Nerima, 2020; pers.com., Spooner, 1, 2020).

“It’s every city, and unless authorities actually get a grip with the level of corruption and the level of police and including police corruption, you're not going to make very much progress in formalization or improvement of the paratransit industry” (pers.com., Spooner, 1, 2020).

If everything is planned and developed in a **rush**, this might hinder a successful interaction between BRT and paratransit. It is mentioned twice that paratransit has been part of the transport ecosystem *“for ages”* and that it takes time to transform it (pers.com., Lougovoy, 1, 2020; pers.com., Mwanika, 2020).

5.4.3 Socio-cultural barriers

One socio-cultural barrier is the lack of understanding that the cultures differ in the Global North and the Global South. Even though many interview partners favored the development of BRT, they were reluctant to support a **one-to-one replication** of a successful BRT system. Many of the BRT systems build all over the world use Bogotá as an example. While the system is seen as very efficient (pers.com., Camacho, 1, 2020), other interview partners mention that it is a problem to replicate the system without looking at the city context (pers.com., Behrens, 1, 2020; pers.com., Spooner, 1, 2020). Behrens also mentions that while policymakers looked at the systems that were running in Curitiba and Bogotá, the *“structure of South African cities makes it really, really difficult to replicate those kinds of successes.”* In South Africa, for example, this is attributed to the long distances the MBTs have to drive where there is little-to-no passenger turnover, which leads to a low revenue (pers.com., Behrens, 2020). It is, therefore, essential to look at the *“urban form preconditions for a viable BRT system”* (pers.com., Behrens, 1, 2020). The focus should be on developing *“contextually grounded solutions”* instead of finding a solution *“that had been developed elsewhere,”* and then *“applied locally and have similar results”* (pers.com., Behrens, 1, 2020). Sandell (pers.com., 2020) agrees with this point and adds that many public transport developers go in and say, *“it works in these industrialized nations, I am sure it works here.”*

5.4.4 Economic barriers

One of the factors that make the interaction of paratransit with BRT critical is the persistence of a **target system for paratransit drivers** (pers.com., Behrens, 1, 2020; pers.com., Nerima, 2020; pers.com., Spooner, 1, 2020). A target is the amount of money a paratransit driver has to pay the paratransit owner at the end of the day, no matter how the day went; if there was congestion on the street. This leads to drivers working long hours, driving faster than they should, and taking on more people than they can, just to earn a sufficient amount of money. This is why the target system *“has to be sorted out first and foremost”* (pers.com., Spooner, 1, 2020). Instead of the target system, drivers should be paid through a regulated salary so that they are incentivized to move away from an endangering style of driving (pers.com., Behrens, 1, 2020).

Lougovoy (pers.com., 1, 2020) also sees it as a problem that if the paratransit system is formalized, drivers would not get cash every day and have to pay taxes, which might be a hindering factor for paratransit operators to agree on a formalization. In the survey conducted in Kampala, Uganda, by Spooner (pers.com., 2, 2020) the reduction of income was seen as the biggest reason for opposing the construction of BRT by the taxi crews (27 out of 88).

One of the most mentioned technical solutions is an **all-compassing ticketing system** through which passengers only pay once but are able to use different modes of public transport, trunk and feeder routes included (pers.com.; Behrens, 1, 2020; pers.com., Camacho, 1, 2020; pers.com., Konco, 2020; pers.com., Lougovoy, 1, 2020; pers.com., Morsing, 2020; pers.com., Nerima, 2020; pers.com., Sandell, 2020; pers.com., Templeton, 2020; pers.com., Timoth, 2, 2020). There are different ways on how to proceed with this ticketing system, either via card or mobile phone.

"It is not going to be cards. It seems much more likely that a workable solution is going to be through some kind of cell phone fare collection system" (pers.com., Behrens, 1, 2020). Morsing (pers.com., 2020) agrees but adds that installing such a system in an old tros tros will be quite expensive, so "simpler, more modern technology" is needed. One additional advantage mentioned regarding the ticketing system is that it gives "stronger power to the regulators if they control the inflow of the money" (pers.com., Morsing, 2020). One problem regarding the ticketing solution is that many of the MBT owners "distrust third parties when it comes to managing their cash flow" (pers.com., Behrens, 1, 2020).

Another idea on how to improve the one ticket solution is to connect it to the GPS position. This way, passengers could board whichever bus, and the app would register which solution is in use, and the passenger is charged without any additional input (pers.com., Sandell, 2020). According to Sandell, this idea is far in the future. Camacho (pers.com., 1, 2020) also focuses on how to make things much smoother if whichever transport system could be ordered via an app. Depending on how many people at that time want to take a public transport solution, a bus, a car, a bicycle would be sent.

Additionally, Camacho (pers.com., 1, 2020) argues that areas that are further away from the closest stop should be prioritized. Another aspect mentioned by Sandell (pers.com., 2020) is the improvement of bundling people via an app. He imagines that once passengers arrive from a larger transport service, such as BRT, it can be assessed where people are going next and bundle the passengers to one group to simplify it for the drivers. Yssoufou (pers.com., 2020) also mentions that there should be a strong focus on digitalization in general, as only this can create new jobs for existing workers.

Another factor that leads to a successful BRT system is if **the system is subsidized**. Both interviewees with a union perspective mentioned that the BRT systems, which are not subsidized, are failing (pers.com., Mwanika, 2020; pers.com., Spooner, 1, 2020). "*Any city in the world that's got decent urban transport system is subsidized and / or it's publicly owned*" (pers.com., Spooner, 1, 2020).

6. Analysis

The analysis chapter uses the results from both the literature review and the interviews and places it into the conceptual framework from chapter 2. The first part deals with the optimization of paratransit vs. transition / transformation of scheduled public transport. The second part focuses on how multi-regimes in the land passenger mobility system can interact with each other. The third part introduces socio-technical barriers that might hinder a successful interaction between BRT and paratransit.

6.1 Transition pathways

As argued in chapter 2.3, most of the transition pathways (transition / transformation) focus on the development of a niche innovation and not on the optimization of an already existing regime, especially when it comes to the Global South (Ghosh & Schot, 2019). In this paper, the scheduled public transport and the paratransit regime are seen as two regimes within the land passenger mobility system. BRT is considered as a niche innovation which already broke through and is now part of the scheduled public transport regime. This part, nevertheless, asks to take a step back and look at why this transition pathway was chosen over the optimization pathway of an already existing public transport mode. It is, therefore, crucial to understand why the actors involved in this system favored the introduction of BRT over the optimization of paratransit. Furthermore, it should be mentioned that the focus of this paper is not to understand which transition pathway (transformation, technological substitution, reconfiguration, or de-alignment and re-alignment) the introduction of the niche innovation BRT led to but to understand which land passenger mobility system change (transition, transformation, or optimization) was favored by the interviewees. This paper, therefore, uses transition and transformation interchangeably, and future research should focus on analyzing how the development of BRT changes the regime of scheduled public transport.

All but one interview partner prefer the development of a BRT and, therefore, the transition / transformation of scheduled public transport, instead of the optimization of the paratransit regime. There are several reasons for that. Against the optimization of the paratransit regime stands that the drivers are seen as unreliable and uneducated and that the vehicles used are unsafe (pers.com., Lougovoy, 1, 2020). For the transition / transformation of the scheduled public transport regime, that a BRT system is efficient, reliable, eco-friendly, and accommodates vulnerable groups as well (pers.com., Mwanika, 2020; pers.com., Nerima, 2020; pers.com., Timoth, 1, 2020). One of the hopes is that when BRT is able to break into the public transport regime, it spills over to the paratransit regime, which then gets optimized and upgraded simultaneously (see chapter 6.3).

6.2 Multi-regime interactions

Paratransit and scheduled public transport are seen as two regimes next to private transport, which are all part of the land passenger mobility system. As argued by Geels (2012) as well as Raven and Verbong (2007), it is important to look at the entire system with its multi-regimes to understand how different landscape pressures and various niche innovations change the dynamic of the whole system, instead of only focusing on one niche innovation. This notion of wholeness is also supported by the interviewees (pers.com., Camacho, 1, 2020; pers.com., Morsing, 2020; pers.com., Spooner, 1, 2020). The land passenger mobility system consists of different regimes, which have to be considered and which have to work together for a successful public transport offering.

Building onto 6.1, as the next step, it is crucial to understand which interaction possibilities the scheduled public transport regime (BRT) and paratransit have. The theory chapter in 2.3 introduced four different interaction ways, namely, competition, symbiosis, integration, and spill-over (Raven & Verbong, 2007). In the literature review, four different terms, meaning similar approaches, were named, namely acceptance, hybridity, replacement, and prohibition. From here on, the terms competition, hybridity, and replacement will be used, and an overview can be found in Table 9.

Table 9. Theory vocabulary vs. literature review vocabulary

Theory Vocabulary according to Raven and Verbong (2007)	Literature Review Vocabulary according to Cervero (2000) / Behrens (pers.com., 2, 2020)
Competition: Two regimes behave similarly	Acceptance: Paratransit exists and competes with BRT
Symbiosis: Cooperation between two regimes	Hybridity: The paratransit and BRT system act complementary
Integration: Absorption of one regime into the other	Replacement: Paratransit gets included and replaced by BRT

Socio-technical regimes within a mobility system, in this case, scheduled public transport and paratransit within land passenger mobility system, can interact by competing with each other, which is the case if paratransit were to continue to exist unregulated (**Competition** / Acceptance). The second choice the regimes have is to cooperate and complement each other; the paratransit and BRT system would, therefore, cooperate with each other (Symbiosis / **Hybridity**). The third choice relates to the integration and, therefore, absorption of one regime into another, which means an *in toto* replacement of paratransit (Integration / **Replacement**). The fourth "theory" interaction type, spill-over, has been addressed in chapter 6.2. In contrast, the fourth "literature review" interaction type, prohibition, is included in this chapter, which relates to a ban on paratransit. The different options are shown in Figure 14.

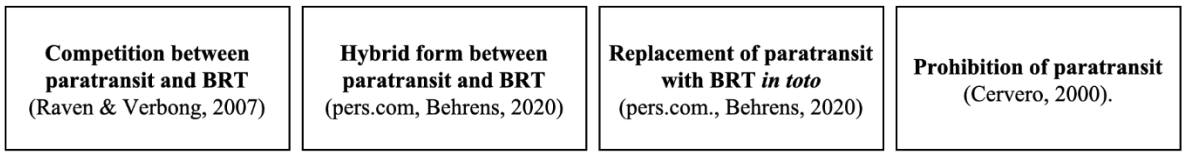

Figure 16. Interaction approaches.

Paratransit and BRT interaction, therefore, have the four following approaches: Acceptance of paratransit and, therefore, competition between paratransit and BRT, a hybrid form between paratransit and BRT, replacement of paratransit with BRT *in toto*, and the complete prohibition of paratransit. These four options are analyzed in chapter 6.2.1 and 6.2.2.

Before this chapter dives into the interaction between scheduled public transport and paratransit, the relationship of these two regimes with the other regime, the private transport regime, has to be defined. Both the empirical results as well as the literature review make it clear that both of the public transport regimes compete with the private transport regime. In other words, while scheduled public transport and paratransit have their own quarrels to fight, they stand united against the private transport regime and try to present the better, more environmentally friendly option (pers.com., Camacho, 1, 2020; pers.com., Konco, 2020; pers.com., Mwanika, 2020; pers.com., Nerima, 2020).

Both the competition and prohibition interaction approach are doomed undesirable. Competition would lead to paratransit and BRT competing in an unregulated market, which would lead both to a rise in the negative aspects of paratransit (Cervero, 2000, p. 165), as well as to an unsuccessful BRT, as its infrastructure might also be used by paratransit (Satiennam, *et al*., 2006). The prohibition approach is seen as not feasible, as it often does not work and as it increases criminal activity (Ezeibe, *et al.*, 2017). Therefore, only the hybridity and replacement approach can be seen as viable alternatives.

6.2.1 Hybridity

In the hybridity approach, the scheduled public transport regime, and thus the BRT system, and the paratransit regime work together and complement each other. As described in the literature review, there are several ways of how to achieve hybridity. Paratransit and BRT can work together in the following ways: connecting corridors, intra-corridor arrangements, and feeder-trunk, which could work via area licensing / route licensing, concessioning or franchising, or contracting depending on how

much paratransit should be formalized (Behrens, et al., 2016; Ferro, et al., 2012; Jennings & Behrens, 2017).

The approach seen as most successful in the literature review as well as by the interview partners is to have paratransit function as the feeder to the BRT hub. For this scheme to function successfully, the paratransit operators have to improve their driving style, maintain their vehicles, and follow safety rules (Behrens, *et al.*, 2018). This option has several advantages. Firstly, it allows paratransit to play an active role in the development of the land passenger mobility system (pers.com., Morsing, 2020). Secondly, this option would give passengers greater comfort as they could get picked up in remote areas in which BRT does not operate (pers.com., Lougovoy, 1, 2020; pers.com., Nerima, 2020). Thirdly, this solution would ease congestion in the cities rapidly, as every transport mode has its role (pers.com., Lougovoy, 1, 2020). Fourthly, it would be able to outcompete private car use (pers.com., Camacho, 1, 2020). Additionally, the hybrid approach does not mean that paratransit cannot be formalized (itf, 2019, p. 37). In Mitchells Plain, South Africa, the MBTs voluntarily established themselves as the 7th Avenue Taxi Association, which is contracted to provide schedule services to the BRT system (pers.com., Behrens, 1, 2020). For a successful hybrid approach, paratransit, therefore, has to be formalized in some way (pers.com., Camacho, 2, 2020; pers.com., Lougovoy, 2, 2020).

Kost (pers.com., 2020) argues that paratransit operators would not agree to a feeder-trunk scheme as it is not an economically viable solution for the paratransit workforce. When looking at the literature review, however, different papers argue that with the right incentives, it is possible to turn the feeder-trunk scheme into a viable solution (Del Mistro & Behrens, 2015) (Plano, *et al.,* 2020).

With regard to how a feeder-trunk scheme could operate, area licensing was the approach favored by three interview partners (pers.com., Behrens, 1, 2020; pers.com., Camacho, 1, 2020; pers.com., Spooner, 1, 2020). Other options were not mentioned in the interviews. These approaches and the degree of formalization of paratransit, therefore, have to be researched further to understand which option is the most successful.

6.2.2 Replacement

In the replacement approach, paratransit would be organized in new organizational groups with the end goal of total replacement of paratransit. The replacement of paratransit is seen as taking a tremendous amount of time, while the negotiations with paratransit operators might also prove unfruitful, and the replacement is unlikely to happen (Ferro, *et al.*, 2013, p. 121). Furthermore, BRT is not able to cater to the entire city, which makes paratransit indispensable (pers.com., Morsing, 2020). The full-scale replacement option might also be too expensive, which makes it less competitive to other kinds of transport system (pers.com., Camacho, 2, 2020). The different options and who is in favor of which are shown in Table 10.

Table 10. Approaches: Definitions and perspectives

Approach	Hybrid	Replacement
Definition	Acceptance + Hybrid form between paratransit and BRT (co-existence of scheduled regime and paratransit regime) (pers.com., Behrens, 2, 2020)	Replacement of paratransit with BRT in toto (often seeking to incorporate incumbent paratransit into new formal operating companies) (pers.com., Behrens, 2, 2020)
Favored by	Academics: "Feeder-trunk-distributor services offer particular promise for complementary hybrid public transport systems, and the successful incorporation of paratransit incumbents" (Ferro, *et al.*, 2013, p. 121; Graeff, 2009; Jennings & Behrens, 2017, p. 10; Nguyen & Pojani, 2018; Schalekamp & McLachlan, 2016). Unions: "Investment for the transition of current informal services into a formalized, effective and efficient system, rather than contracting out to external companies" (itf, 2019, p. 37) Interviewees: "Paratransit and BRT would play a complementary role" (pers.com., Behrens, 2020; pers.com., Camacho, 2, 2020; pers.com., Lougovoy, 1, 2020; pers.com. Morsing, 2020; pers.com., Mwanika, 2020; pers.com., Nerima, 2020; pers.com., Sandell, 2020; pers.com., Spooner, 1, 2020; pers.com., Templeton, 2020)	ITDP: "Such feeder services are not operated by informal operators, but by modern companies, and they form an integral part of the BRT system" (ITDP, 2017, p. 172) Interviewees: "The goal is to completely replace *dala dala* in Dar es Salaam" (pers.com., Timoth, 2, 2020)

When looking at the two remaining approaches, hybridity and replacement, the hybrid approach is not only favored by academics and unions, but also by many of the interview partners. It is essential to understand that paratransit is an incremental and persisting part of the land passenger mobility system, which should not be seen as a hindering factor. Furthermore, it is necessary to decolonize knowledge about transport and involve "indigenous communities" in the context of the Global South (Schwanen, 2018, p. 5). Paratransit operators and drivers should, therefore, be met on an equal footing. In the end, both regimes want to achieve the same thing: to get passengers to use their car less and public transport more. Nevertheless, the paratransit regime has to be formalized and held accountable for laws and regulations (pers.com., Lougovoy, 1, 2020). A successful system can only be achieved by including the paratransit regime from the beginning and to include them step by step, instead of through a "big bang" that changes the entire system in one go (pers.com., Behrens, 1, 2020; pers.com., Camacho, 1, 2020).

6.3 Human actors

Actors are the ones who are building socio-technical systems (Geels, 2004). To understand socio-technical transitions, it is, therefore, important to focus on the entire system, including its actors (Geels,

2004, p. 900). In multi-regime interactions, actors who did not cooperate before, are starting to work together (Raven & Verbong, 2007). This is why the inclusion of all actors is crucial to the success of a project, especially in transport planning since the decision has a profound impact on all stakeholders (Pira, *et al.*, 2016). As shown in chapter 2.6 the paratransit regime consists of workers on-board, stage workers, and paratransit service workers, as well as the operators (GLI, 2019, p. 17). Stakeholder theory argues that it is necessary to understand who the stakeholders in a project are, what outcome they are aiming towards, and how their relationship is (Roberts, 2003).

This notion is greatly supported by most of the interview partners (pers.com., Behrens, 1, 2020; pers.com., Lougovoy, 1, 2020; pers.com., Spooner, 1, 2020; pers.com., Templeton, 2020). Without the inclusion of the paratransit workforce, the implementation of BRT is built on unstable ground (pers.com., Behrens, 1, 2020). Paratransit workers, therefore, have to be included from the moment a city thinks about developing a BRT system, and it should be anticipated that these negotiations take some time and should, therefore, not be rushed (pers.com., Lougovoy, 1, 2020; pers.com., Mwanika, 2020). It is also essential to not only talk to the paratransit operators, but also to the drivers and other paratransit workers since all stakeholders are affected differently by the implementation (pers.com., Behrens, 1, 2020; Roberts, 2003; pers.com., Spooner, 1, 2020). Including the paratransit workforce might be difficult as they are sometimes seen as uneducated (pers.com., Lougovoy, 1, 2020).

Nevertheless, if the paratransit regime is not included, it will most likely lead to push-back from the workforce, and the success of the BRT is endangered. The inclusion of the paratransit workforce can, therefore, be seen as a make-it or break-it point regarding the success of the land passenger mobility system. If the paratransit regime is not involved, the barriers described in the following sections will most likely also not be overcome. One way of how paratransit stakeholders can have a stronger voice in these negotiations is to organize themselves in cooperatives, which has proven to be quite successful in Kenya (pers.com., Behrens, 1, 2020).

One group that should be especially focused on during the inclusion of the paratransit workers are women. The paratransit regime, which is a significant employer, is predominantly male-dominated (pers.com., Mwanika, 2020), although it has been heard locally that women might perform better as drivers (pers.com., Behrens, 1, 2020). Some research suggests that this is the case since women drive safer (The City of New York, 2010). In any case, SDG 5 calls for gender equality, and in order to achieve this goal, women should be encouraged to work within the land passenger mobility system. This can be achieved through specialized trainings for women, formation of women in transport groups, and spots in the leadership structure of the regimes (pers.com., Lougovoy, 1, 2020; pers.com., Morsing, 2020; pers.com., Mwanika, 2020).

6.4 Barriers

In the next step, the barriers (technological, political, socio-cultural, and economic barriers) for socio-technical innovations will be used to describe barriers for multi-regime interactions (Table 11) (Egbue & Long, 2012).

Table 11. Barriers and corresponding measures

Barrier group	Barrier	Measure
Political	Paratransit regulations	Mix of regulations + incentives(financial, vehicles)
Political	Corruption	?
Technological	Design of Stations	Inclusion of paratransit needs Parking spots for paratransit vehicles
Socio-cultural / technological	Replication of successful systems	City-by-city approach
Socio-cultural	Local opposition	Involvement of all stakeholders
Economic / technological	Target System	Monthly salary Cashless Fare Collection Strong focus on digitalization
Economic	Competitiveness	Subsidy

These barriers are further presented in 6.4.1- 6.4.4.

6.4.1 Technological barriers

As described in chapter 2.1.5, technological barriers, which are important here, are (a) technological barriers and (b) infrastructure barriers (Browne, *et al.*, 2012, p. 144).

One technological barrier is to believe that the infrastructure or the "urban form preconditions" (pers.com., Behrens, 1, 2020) are the same in every country, and successes can, therefore, be replicated easily. The experiences in the Global North differ from experiences in the Global South, and it is, therefore, essential to understand the dynamics and power of the context first (Raven, *et al*., 2017). The public transport infrastructure, but also the actors of each city, should be assessed thoroughly so that a solution is tailored to a city (pers.com., Behrens, 1, 2020; pers.com., Spooner, 1, 2020).

Another barrier regarding the successful interaction between paratransit and scheduled public transport is the design of BRT stations, which are currently not designed with paratransit in mind (pers.com., Spooner, 1, 2020). BRT terminal designers should, therefore, include the paratransit workforce in planning the stations. Furthermore, as of now, paratransit often hinders the flow of the BRT system if paratransit vehicles are parked in designated BRT stops. To combat this, parking stations for paratransit vehicles should be built separately (pers.com., Lougovoy, 1, 2020). Additionally, it could be suggested to align the BRT system more towards the paratransit system and include the workers who are part of the paratransit regime to make the entire land passenger mobility system safer and give previous informal workers jobs (pers.com., Spooner, 1, 2020).

6.4.2 Political barriers

Political barriers can both be institutional and administrative (Browne, *et al.*, 2012, p. 145) and refer to changes in, e.g., corruption (Sovacool & Bambawale, 2011). In order to overcome these barriers, Geels mentions "traffic rules, environmental standards, car taxes, and parking" (Geels, 2002, p. 1258). One of the political barriers, which hinder a successful interaction between scheduled public transport and paratransit, is the **resistance towards regulations** from the paratransit regime. Concerning the paratransit regime, regulations and policies seem to be hard to implement (pers.com., Morsing, 2020). Instead, the paratransit workforce should be nudged to behave a certain way through incentives (pers.com., Behrens, 1, 2020) or a mixture of incentives and regulations (pers.com., Lougovoy, 1, 2020). Incentives can be financial so that the paratransit workers are encouraged to improve their service (pers.com., Behrens, 1, 2020) or practical such as training for the drivers (pers.com., Lougovoy, 1, 2020). These trainings can focus on traffic rules, safe driving practices, and vehicle maintenance, but also on customer relations and conflict resolution (Cervero, 2000, p. 170). Regulations can be to enforce safety standards more strongly (changing tires every other year) (Cervero, 2000, p. 163).

Corruption is a deciding barrier in the interaction between scheduled public transport and paratransit since many politicians and police have a stake in the paratransit regime and would be worse off if paratransit were to be replaced *in toto*. Corruption, therefore, enables paratransit to operate while at the same time hindering a legitimization of them (Cervero, 2000, p. 163). While there is no quick fix for corruption, it should be high on the priority list of barriers to overcome (pers.com., Lougovoy, 1, 2020; pers.com., Morsing, 2020; pers.com., Nerima, 2020; pers.com., Spooner, 1, 2020).

6.4.3 Socio-cultural barriers

Socio-cultural barriers relate to the cultural and social dimension of public transport (Sovacool, *et al.*, 2011). As written in the theory chapter, one example of socio-cultural barriers on regime level are local opposition (Sovacool, *et al.*, 2011). In Nairobi has the publishing of a report on the impact of BRT on paratransit workers lead to pushbacks from the union (itf, 2019). To overcome local opposition, it is necessary to involve all stakeholders.

6.4.4 Economic barriers

One of the barriers that hinder a successful interaction between the scheduled public transport regime and the paratransit regime is the **target system** (pers.com., Behrens, 1, 2020; pers.com., Nerima, 2020; pers.com., Spooner, 1, 2020). In order for this to happen, the drivers need to be paid a regular salary so that they are not depending on the weather or number of customers coming in. This point, nevertheless, has to be handled carefully and in accordance with paratransit drivers and operators. If the paratransit workforce feels that they might get less money or if they are not able to understand how the money is handled, it might lead to uproar of the drivers and operators (pers.com., Lougovoy, 1, 2020).

One possibility to enforce the salary solution is the introduction of CFC. There are different CFC systems such as an SMS service, a credit card billing based technology, contactless NFC card, or one linked to mobile based technology (Schalekamp, *et al.*, 2017). While all interviewees support this point, the literature research has shown that so far, the systems have not been very successful as stakeholders were following different interests as well as a lack of coordination (Tinka & Behrens, 2019, p. 10). Nevertheless, this option has to be researched and tested in order to both strengthen the interaction between BRT and paratransit as well as to guarantee the paratransit workforce a monthly income. As with most of the regime dimensions, the inclusion of the paratransit workforce is of extreme importance to its success. Here it also has to be remembered that the selling of tickets is a job for workers in the paratransit regime, especially for women, who would be threatened if CFC is introduced (itf, 2019).

Once CFC is established in the public transport regime, it can be enhanced by, e.g., adding the GPS location of its customers so that the passengers do not have to actively buy a ticket, but that the ticket will be purchased automatically as soon as mode and length of transport is registered (pers.com., Sandell, 2020). Furthermore, CFC could be improved if it lets the passengers order a mode of transportation via the app as well (pers.com., Camacho, 1, 2020) or if it bundles people who are going in the same direction (pers.com., Sandell, 2020). Generally, a strong focus on digitalization will help to enhance the current system (pers.com., Yssoufou, 2020).

One factor of sustainability transitions is that innovation is often not able to compete with existing technologies if it is not subsidized (Geels, 2011). The ITDP believes that one of the strengths of BRT is that it is able to operate without a subsidy, while the ITF and GLI argue for a subsidized system so that the fares are able to be paid by the poor as well (itf, 2019). As of now, most of the BRT systems analyzed in this paper are subsidized. These findings raise the question if the ITDP should rethink its stance on subsidies. Additionally, there should be a conversation on how to subsidize paratransit as well to level the playing field.

6.5 A conceptual framework in combination with results and analysis

In chapter 2.7, the conceptual framework was introduced. After looking at the results and, in the next step, analyzing them, this paper turns again to the conceptual framework to close chapter 6. This paper combines socio-technical transition theory and stakeholder theory. These two theories benefit greatly from each other, as socio-technical theory specifically includes human actors and stakeholder theory allows to dive deeper into the role these actors have. This can especially be seen in chapter 6.3. Here, the actors that are part of the BRT or the paratransit regime are in focus. Future research could focus more on how to involve the stakeholders in successful multi-regime interactions, which could be letters, posters, via telephone, questionnaires, direct surveys, exhibitions, focus groups, stakeholder conferences, or referendums (Cascetta & Pagliara, 2013).

7. Discussion

This chapter focuses on the research questions, referring back to points found during the research, as well as making connections to other studies. This chapter firstly answers the two research questions posed in section 1.4, takes a closer look at how well the theory fits to the topic chosen, and then introduces four discussion points, namely other feeder solutions, the dominance of the car-based transport system, paratransit, and the SGDs, and paratransit during a pandemic.

7.1 Interaction of public transport regimes

The questions posed in chapter 1.4 focus on how the paratransit regime and the scheduled public transport regime can successfully interact. Out of the four options, namely competition, hybrid form, replacement, and prohibition, the hybrid form between paratransit and BRT, as well as the replacement of paratransit with BRT *in toto* are the most feasible. This paper tends towards favoring the hybrid form as it allows paratransit to play an active role, while also contributing to a wide reach of the entire public transport system. By including paratransit, knowledge about transport gets decolonized granularly, which is important in the Global South. The question remains of how the hybrid form works best. The most likely approach is a feeder-trunk scheme, where the different ways this could take (area licensing, concessioning, franchising, contracting) still have to be researched more thoroughly. This paper follows the line of argumentation presented by Behrens, who together with researchers such as Schalekamp, Ferro, Plano, and Klopp, has argued in multiple papers that a hybrid system is the most feasible solution compared to a replacement approach. It is advised to follow the research of Plano, *et al.* (2020) to understand the different hybrid solutions better.

7.2 Barriers for interaction between systems

Before diving into technological, political, socio-cultural and economic barriers, it is important to look at the actors of a socio-technical system, since they are the ones building it. The most important take-away here is that for a successful transport system, all stakeholders, the scheduled public transport and paratransit ones, have to be included and given a voice in the development. It should be stressed that the paratransit stakeholders do not only consist of operators but also drivers and people working both on and off the vehicles, who should be taken into account. Then, as a next step, the other barriers can be tackled.

The socio-technical barriers have been divided into technological, political, socio-cultural and economic. Regarding the economic barrier, the target system of paratransit drivers has to be replaced by a monthly salary. The implementation of CFC can support this. The political barrier, which has to be overcome, is corruption and finding the right way of how to incentivize paratransit to cooperate with the scheduled public transport system. The technological barriers focus on the design of BRT stations, which should be built with the paratransit workforce in mind. Local opposition, the socio-cultural barrier, has to be met by including the paratransit workforce from the beginning. Lastly, BRT systems should not just replicate solutions found in other countries but understand the culture of each country and develop grounded solutions.

7.3 Applicability of theory and method

Semi-structured interviews were the right method for this paper. Nevertheless, the vocabulary used when asking questions could have been more clear-cut. In some of the interviews, the interviewees described a hybrid system, while then favoring a replacement approach when directly asked. One problem during the interviews was the lack of understanding of the word “paratransit.” For example, informal transport and paratransit were used interchangeably, which created confusion. Additionally, in different contexts, paratransit can also mean public transport for disabled people. Looking back, it would have been necessary to give a clear-cut definition of the words before the interview.

Future research should, therefore, use and share concrete definitions of words such as hybrid approach, replacement approach, and paratransit.

Socio-technical systems theory and the MLP is a helpful tool to understand niche innovations and socio-technical transitions. However, the focus of this paper was how multi-regimes interact once a niche innovation changed one of the regimes. The theory was not able to explain barriers between multi-regimes very well, which is why socio-technical barriers to transitions were used as a categorization. Therefore, socio-technical transition theory helped explain the entire transport system and provide the right vocabulary; another theory that focuses more on interaction barriers might have proven more useful.

7.4 Other feeder solutions

During the interviews and the analysis, other discussion points appeared. Feeder services are currently not only being offered by paratransit operators. Uber, for example, already moved into Kampala, Uganda, offering uberBODA (Uber Blog, 2018). And on-demand transit provider Via is currently establishing feeder solutions in cities such as Berlin, London, and New York (Via, n.d.). It is just a matter of time until Via considers moving into markets in SSA as well. If this is the case, how do new feeder solutions, paratransit, and BRT cooperate? One of the points mentioned the most was the inclusion of the paratransit workers. Therefore, it is strongly advised, no matter what kind of new transport solutions are implemented in SSA, to take the paratransit workers' perspective into account and develop the land passenger mobility system together.

7.5 Dominance of the car-based transport system

Geels has been focusing on analyzing the car-based transport system through socio-technical transition theory and the MLP. In his research, he has concluded that the car-based transport regime will continue to be the dominant mode of transport for the next 20 years (Geels, 2012). This notion can be described as a technological lock-in, a situation where a socio-technical system is continuously supported by the economy (Unruh, 2000). Nevertheless, other modes of transportation, such as BRT, will grow further, and there will be a call for greener technology as well. For this transition to happen, Geels proposes to support other niche innovations, to put pressure on the car regime by using different economic instruments (he names "carbon taxes, emission trading, road pricing), as well as regulation (e.g., environmental") (2012, p. 479). For future research, it is advised to look at the entire land passenger mobility system, including paratransit, scheduled public transport, and private transport, to understand how niche innovations affect multi-regime interactions.

7.6 Paratransit and the SDGs

In chapter 1.3, it was mentioned that SGD 8, 9, and 11 focus on building a city more inclusive and sustainable. Simultaneously, the introduction of a sustainable, new transport innovation, such as BRT, might lead to job loss and, therefore, miss of SDG 8. By including paratransit in the conversation, SDG 8 can also be accomplished. The next step, then, is to focus on making paratransit more environmentally friendly, and, therefore, to achieve SDG 11.2 also from the paratransit side. As of now, "environmental, noise and optimized operational efficiencies are not top priorities for paratransit operators" (Ferro, 2015, p. 14). There has been research conducted on the environmental friendliness of paratransit in other parts of the world than SSA. Nugroho and Zusman (2018), for example, researched how paratransit drivers in Jakarta, Indonesia, are not willing to switch to low-emission vehicles without corresponding subsidies and demand management policies. In a different paper, paratransit in the Philippines is assessed by looking at how environmentally friendly this mode of transport is. The authors argue that the paratransit there, the jeepneys, are converting to compressed natural gas (**CNG**), which will lead to carbon reduction and making paratransit environmentally friendlier (Regidor, *et al.*, 2009). Generally, no matter if paratransit is contracted as a feeder or gradually integrated into the BRT,

it is important to regulate and incentivize paratransit to adhere to environmental standards so that it also becomes “safe, affordable, accessible and sustainable” (United Nations, 2015).

7.7 Paratransit during a pandemic

This paper was written during the Covid-19 outbreak, and the question, therefore, rose how a pandemic affects the informal economy. While at this point, there is no academic research on how Covid-19 affects paratransit workers in SSA cities, examples from the informal economy in India show that the pandemic affects the informal economy tremendously since the workers are often only paid via a target system (Chandrasekhar & Ghosh, 2020). One newspaper article, which describes the current situation in Kenya, stresses that social distancing is very hard to achieve in “other informal sectors like in public matatu transport, vehicle repair and metal work” (Kinyanjui, 2020). The person interviewed, Njeri Kinyanjui, a senior research fellow at the Institute for Development Studies, University of Nairobi, argues that in the long-term, cities have to be built by having informal and paratransit workers in mind (Kinyanjui, 2020). This extraordinary situation stresses the point that the informal sector has to be formalized in some way so that paratransit workers do not have to fear for their livelihood if a situation like this arises again and that cities have to include all people in their planning.

8. Conclusions

This chapter summarizes the learnings so far, shows how this paper has contributed to the current research gap, and suggests what future research can focus on.

8.1 Summary

This project set out with an aim to explain what interaction approaches between scheduled public transport (BRT) and paratransit there are. An understanding of the crucial role of paratransit in the public transport landscape of cities in SSA grew with every step in the project. This mode of operation has its advantages but also disadvantages. Most public transport planners agree that to make public transport in SSA reliable, efficient, and sustainable, it has to be optimized or transformed in some way. One intervention is a BRT system, which operates on dedicated bus-only lanes. This thesis focused on the interaction between paratransit and BRT by using socio-technical transition theory.

The paper first focused on why the development of a BRT system has been favored over the optimization of the already existing paratransit regime. The reason here is that the paratransit regime is often seen as less efficient and reliable, while the BRT system promises to be a green, efficient, inclusive, and sustainable solution. It is hoped that once BRT gets introduced, the positive advantages spill-over to paratransit and upgrade this regime as well.

In the next step, different interaction approaches (Figure 15) between paratransit and BRT were collected and analyzed. These approaches are the acceptance of paratransit and thus competition with BRT, a hybrid form between paratransit and BRT, the replacement of paratransit, and the prohibition of paratransit. Both the competition and prohibition approach were doomed undesirable. In the replacement approach, the paratransit gets replaced by often forming incumbent paratransit into new formal operating companies. This approach can be seen as too time-consuming and lacking support of the paratransit workforce to be successful. The approach, which seems to be most viable, is a hybrid form between paratransit and BRT as it allows both systems to contribute their strengths. There are different ways on how a hybrid approach could function, and, as of now, a feeder-trunk approach seems most feasible. There are also different ways on how to achieve this, namely area / route licensing, concessioning, franchising, and contracting.

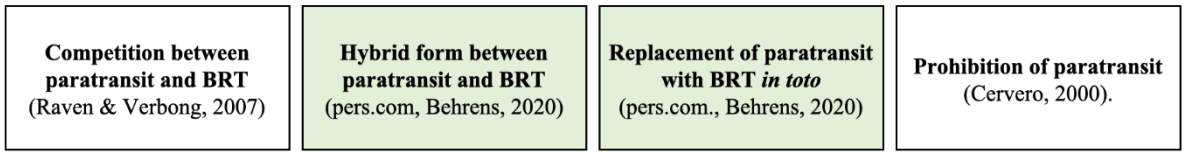

Figure 17. Interaction approaches

Lastly, the actors involved in the socio-technical system and socio-technical barriers and corresponding measures were analyzed. The biggest take-away when looking at the actors of the land passenger mobility system is that all stakeholders have to be involved, which includes paratransit drivers and people working on and off the vehicles. This paper has shown that when these stakeholders are not included, there might be resistance that might compromise the success of the BRT. The socio-technical barriers used were divided into technological, political, socio-cultural and economic barriers. A successful paratransit / BRT interaction benefits from the move from a target system to a monthly salary for the paratransit driver, which can be supported by installing CFC in all vehicles. There should both be regulations and incentives so that paratransit acts as a reliable partner for the BRT system. It should be noted that a successful paratransit / BRT interaction cannot easily be replicated in another country without looking at the urban form preconditions. Stations should be planned with the paratransit regime in mind, and local opposition can be overcome by including all stakeholders.

8.2 Future Research

This paper contributed to the current literature by giving an encompassing picture of interaction possibilities between paratransit and BRT, while also focusing on the barriers and corresponding measures for a smooth collaboration. Nevertheless, there is still a demand for future research in this field. Future research could focus on

- paratransit / BRT interaction in only one city in SSA to understand the socio-technical system more profoundly
- the different hybrid approaches, especially looking at reward schemes, area / route licensing, concessioning, franchising, and contracting
- corruption, and the interaction between paratransit and BRT in SSA, as this paper did not dive into ways of how to fix corruption
- the inclusion of women, both in the BRT and paratransit workforce, as well as in public transport development in general
- the entire land passenger mobility system, including paratransit, scheduled public transport, and private transport, to understand how niche innovations affect multi-regime interactions
- environmental sustainability of paratransit vehicles

There is no one-size-fits-all solution on how to interact with paratransit, once BRT is developed. It is essential to look at the urban form preconditions, make an assessment of all stakeholders involved, involve all of the stakeholders in the discussion, and move on from there. In the end, everyone involved in public transport wants to offer a more sustainable solution than the car and, thus, make the world a little bit greener.

Acknowledgments

This thesis would not have been possible without the support from Uppsala University and the Swedish University of Agricultural Sciences, Scania, and my family and friends.

First and foremost, thank you to my supervisor Cecilia Mark-Herbert who read through countless drafts of this thesis, who never grew impatient over my lack of formatting, and who provided incredibly valuable feedback. Thank you also to Hans Andersson, my subject reviewer, for his feedback. Additionally, thanks to everyone who took their time to be interviewed for this thesis, as well as answering my follow-up questions. Here, I would like to especially thank Dave Spooner, who provided me with valuable data, as well as Roger Behrens, who helped me find my red threat.

This thesis would not have been possible without Scania, and my fantastic team of supervisors, namely Lisa Osbäck, Jonas Strömberg, and Erik Hansson. Proud to have worked with pioneers in sustainable transport.

Last but not least, thank you for the support from family and friends both in Germany and Sweden. You made this project so much easier with your encouragement, calls, packages, and home-cooked food I received over the past four months.

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Personal communication

Behrens, Roger
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1. Skype interview (24.02.2020)
2. E-mail (11.03.2020)

Camacho, Nicolas
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2. E-mail (15.04.2020)

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1. WhatsApp (24.03.2020)

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1. Skype (17.03.2020)

Lougovoy, Nicolas
Scania, Head of Strategic Projects at Scania West Africa
1. WhatsApp (12.03.2020
2. E-mail (15.04.2020)

Morsing, Fredrik
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1. Skype (11.03.2020)

Mwanika, John Mark
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1. Skype (27.02.2020)

Nerima, Tamara
Scania, Marketing Communication Director at Scania East Africa
1. Teams (11.03.2020)

Sandell, Karl Oskar
Scania, Sustainable City Solutions
1. Teams (12.03.2020)

Spooner, Dave
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1. Skype (21.02.2020)
2. Unpublished survey of paratransit workforce in Kampala, Uganda (20.02.2020)

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1. Skype (09.03.2020)

Timoth, Eliavera
Scania, Marketing Manager at Scania Tanzania
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2. E-mail (20.03.2020)

Yssoufou, Cisse
UATP Africa, General Secretary

1. E-mail (31.03.2020)

Appendix A. Interview Guide

1. Introduction and Key questions

The first part of the interview deals with personal experience regarding Bus Rapid Transit and paratransit. Depending on this author's previous knowledge of the background of the interviewee the questions were exchanged, or follow-up questions were asked.

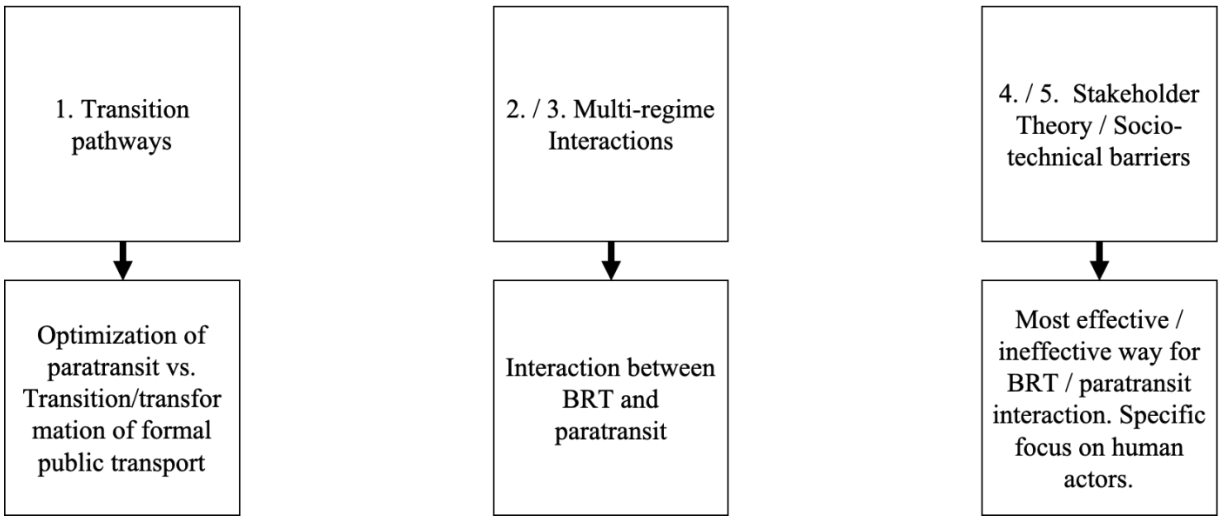
- What is the current development in BRT in *chosen city*?
- How is paratransit structured in *chosen city*?
- Would you say the approach taken there has been successful?
- What are some lessons learned?

2. Questions on personal viewpoint on BRT / paratransit

In the second part of the interview, the interviewees were asked about their personal viewpoint on what the best approach is on how to move forward with paratransit once BRT is introduced. Depending on the knowledge area of the interviewee, some questions were focused on more, whereas other questions were skipped.

1. Would you either choose the optimization of paratransit or the development of a BRT system and why?
2. Which option do you prefer when it comes to BRT and paratransit and why? Any other option you would like to add?
   a. Acceptance + Competition
   b. Acceptance + Hybrid form between paratransit in BRT (co-existence of formal and informal public transport)
   c. Replacement of paratransit with BRT *in toto* (often seeking to incorporate incumbent paratransit into new formal operating companies)
   d. Prohibition of paratransit
3. How would you move forward to achieve a hybrid form? *E.g. area licensing / route licensing, Concessioning, Franchising*
4. What is, for you, the best way to include paratransit in the BRT system? *E.g. Digital ticketing system including the feeder, giving priority to jobs to the workers of the paratransit*
5. What is, for you, the most ineffective way to integrate paratransit in the BRT system?

Themes for research questions with theoretical connection



Appendix B. GDPR Form

Sustainable Development
Laura Messner

Processing of personal data in independent projects

When you take part in Laura Messner's thesis project, Uppsala University (UU) will process your personal data. Consenting to this is voluntary, but if you do not consent to the processing of your personal data, the research cannot be conducted. The purpose of this form is to give you the information you need to decide whether or not to consent.

You can withdraw you consent at any time, and you do not have to justify this. UU is responsible for the processing of your personal data. Your contact for this project is: Laura Messner, lamessner@yahoo.de

I will collect the following data about you: semi-structured interview on paratransit and BRT

The purpose of processing of your personal data is for the UU student to carry out their independent project using a scientifically correct method, thereby contributing to research within the field of Sustainable Development

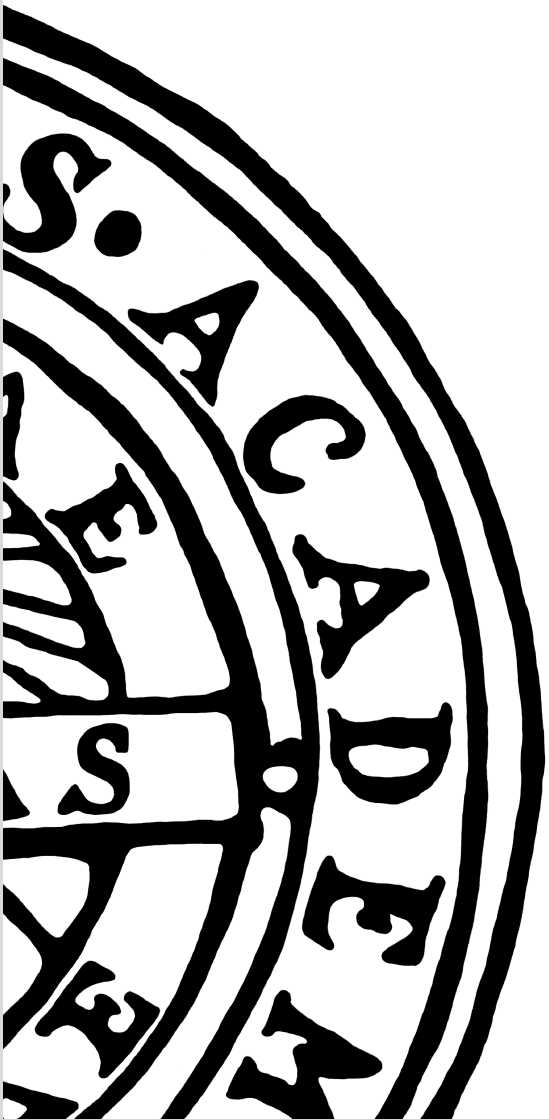
☐ I consent to UU processing my personal data in the way described in this document. This includes any sensitive personal data, if such data is provided.

_____

Signature Place and date

_____

Name in block letters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