Towards evening paratransit services to complement scheduled public transport in Cape Town:

Exploring alternative policy interventions from the minibus-taxi industry's perspective

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Plagiarism declaration

This thesis is my own original work, both in concept and execution. Apart from the normal guidance from my supervisor, I have received no assistance beyond that which is acknowledged.

Neither the whole work nor any part of it has been, is being, or is to be submitted for another degree at this or any other university.

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Abstract

Cities across low and middle income countries are seeking to improve public transport services, but the presence of large numbers of independent paratransit operators complicate reforms. City officials often seek to eliminate paratransit services in favor of scheduled services, typically bus rapid transit, yet this has proven impossible to achieve. Cape Town is one such city, whose planning officials recognize that the transition to and operating costs of new scheduled services are unsustainable. Reconsidering the reform approach, the City has acknowledged a continued role for paratransit services primarily as feeders to scheduled services. This raises the question of how complementary service quality can be obtained at transfer points between scheduled and unscheduled services. The research seeks to assist operators in sharing their perspectives outside of a City-structured engagement process and to assist City officials in understanding what reform paths will be most feasible based on paratransit operator acceptability and cost to the City.

To do so, this study uses a mixed methods approach using a naturally occurring example that mirrors the hybrid network arrangement as espoused by the City. The feasibility of interventions to improve evening service quality complementarity, specifically related to mismatched service span and long off peak headways, is explored with minibus-taxi operators. The two key stakeholders among operators are vehicle owners and drivers who have differing perspectives on the business and reform. Understanding these differing perspectives is critical to successful implementation of future reforms as past attempts have been met with considerable resistance from the industry. Driver perspectives were captured through a stated choice survey while owners were engaged through structured focus groups. Costs of interventions were estimated and combined with stakeholder data to indicate which interventions to extend service into the evening and maintain short headways are most likely to be successful if attempted by City officials.

Results indicate that to extend paratransit services to match scheduled modes, improvements in rank (terminal) security, an increase in fares, or an operating deficit payment incentive are the most feasible of seven interventions explored. The first two require little transition effort or cost to the City but will not address potentially long headways; the third most feasible intervention addresses both service quality issues yet represents a larger burden for the City. Aligned with experience from previous reforms to eliminate paratransit in favor of contracted, scheduled services, this research finds that corporatization of paratransit operators may be less feasible than other interventions explored; this suggests that the City's policy shift is appropriate and that alternative approaches to paratransit reform that are less costly and require less onerous changes from status quo operations are feasible. By undertaking these alternatives, limited government budgets can be spent more effectively and efficiently so public transport reform reaches more residents more quickly.

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1 Introduction

1.1 Background and motivation

Mobility is a basic need, often required for accessing employment, shopping, entertainment, and friends and family. While this mobility can be obtained in several ways, many rely on public transport (PT); in the context of South Africa, including Cape Town, PT is a mix of scheduled services provided by government through contractors and unscheduled services provided by a multitude of independent operators. Because these independent operators do not operate according to contracts specifying service levels and receive no subsidy, services are provided only when profitable and government regulation is limited to quantity licensing where the number of legally operating vehicles is controlled. Improving the overall service quality of the PT network becomes difficult with many stakeholders who are not under the direct control of government planners.

However, improvement of the PT network is needed in Cape Town. Multiple modes operate on independent fare payment systems so passengers avoid intermodal transfers to avoid paying multiple fares (Bruun et al., 2016). As a result, modes often offer duplicative routes, leading to operational inefficiencies as subsidies are provided to rail and bus services duplicated by independent operators. The sprawling and low density urban form of Cape Town also complicates matters, making PT expensive to provide. PT travel time in Cape Town is two to three times longer than car travel time, a critical equity issue when PT serves mainly low income commuters (Hitge & Vanderschuren, 2015). In fact, 94 percent of PT users in Cape Town are in low or low-middle income groups, further highlighting the equity concerns around failing to invest carefully and efficiently in PT reforms (TDA, 2018b).

Many of these lower income individuals live on the periphery because of apartheid spatial planning but also because more recent government housing policy has favored the production of large numbers of housing units which necessitates construction on inexpensive land often located far from desirable locations and places of employment (Bruun et al., 2016). Unfortunately, this exacerbates the challenges faced by low income passengers which make up 25 percent of the city's population; according to planning analysis, they spend more than 10 percent of monthly income on transport costs (TDA, 2018b). Providing service to distant areas with long average trip lengths is expensive for government as well and is aggravated by highly peaked demand (Clark & Crous, 2002; Scorcia & Munoz-Raskin, 2019).

The unscheduled and unsubsidized PT services in Cape Town are called minibus-taxis (MBT). Similar services exist in many cities globally and go by different names in each context, including *jeepneys* (Philippines), *matatus* (Kenya), *danfo* (Nigeria), *trotro* (Ghana), and *car rapides* (Senegal), reflecting the wide range of contexts within which relatively similar services have emerged (Behrens, McCormick, et al., 2016; Cervero, 1985, 2000; Kumar & Diou, 2010; Lau, 1997; Saddier & Johnson, 2018). These services are collectively termed paratransit, a term first used in the United States to describe services that are unscheduled and complement fixed PT (Kirby et al., 1974; Saltzman, 1973). It was later broadened by Cervero (1985) to refer to any transport between private automobiles and fixed PT services, used throughout low and middle income countries to describe privately and independently operated PT services. All respond to demand in both time and space to varying degrees based on local regulation and enforcement. This research uses the definition put forth by Behrens, McCormick & Mfinanga (2016) that describes paratransit as unscheduled PT provided by small-scale private operators within a range of business formality and regulatory schemes.

MBT services in South Africa play a critical transport role as evidenced by the large proportion of road-based passengers carried, but often this benefit is overlooked by many in the media and among the public who see only reckless driving. Many of the positive and negative elements of paratransit in South Africa are similar to those in other countries. Paratransit is often more frequent than scheduled PT, with peak headways measured in seconds rather than minutes, and are more maneuverable in heavy traffic that is commonplace in rapidly growing cities of low and middle income countries (Cervero, 2000). Smaller vehicles provide greater security compared to train carriages because everyone is in view of the driver and often lend a sense of camaraderie as well (Cervero, 2000).

However, disadvantages include unpredictable arrival and departure times for passengers, poor frequency at off peak times, overloading of passengers, aggressive driving, and poorly maintained vehicles (Cervero, 2000; McCormick et al., 2016). Competition between independent drivers in often oversaturated markets is a major cause of these issues, as is the unpredictable pay structure for drivers, where earnings depend directly on how many passengers are carried per day (Cervero, 2000; McCormick et al., 2016). In many cases, and certainly in South Africa, the MBT industry has a fraught relationship with government.

In light of the challenges with the current PT system generally and with MBT services in particular, and because of the country's role as host of the 2010 FIFA World Cup, the national government of South Africa launched the 2006 Integrated Rapid Public Transport Network program to promote the implementation of bus rapid transit (BRT). Branded MyCiTi in Cape Town, the new BRT system would incorporate existing MBT drivers in the areas where BRT would replace them to ensure that

employment opportunities remained constant (City of Cape Town, 2007; Schalekamp & Behrens, 2013; Schalekamp & McLachlan, 2016; Siyongwana & Binza, 2012). To do this, MBT operators were formed into vehicle operating companies (VOCs) that would negotiate 12-year contracts with the City for MyCiTi operations (Schalekamp & McLachlan, 2016).

However, government has since recognized this reform approach is unsustainable. Transition time and costs were higher than expected, with MBT operating license compensation, capacity-building, and other transition activities proving difficult and expensive. Government faced resistance from the MBT industry who felt that City officials were not making enough guarantees of employment opportunities, providing enough ownership opportunities, or acknowledging the important role of the industry in economic empowerment and the pride that operators take in their work (Schalekamp & Behrens, 2010; Schalekamp & McLachlan, 2016; Woolf & Joubert, 2013). Historical distrust of government increased tensions and resistance.

In addition to issues with the reform and engagement process, the resulting BRT system has required much larger operating subsidies than expected (TCT, 2015; Von der Heyden et al., 2015). BRT in South Africa was initially touted as a PT solution that would not require subsidies (Schalekamp & McLachlan, 2016). Some Latin American BRT systems are run without an operating subsidy (Sandoval & Hidalgo, 2002), but this is rare and the MyCiTi system is no exception (TCT, 2015; Von der Heyden et al., 2015).

Because of these challenges, City officials have reevaluated the approach for future phases of BRT implementation, clearly stating in the 2017 Integrated Public Transport Network Business Plan that "the Phase 1 methodology is not viable or sustainable" (TDA, 2017). The intention is to design a hybrid PT network that uses both scheduled and unscheduled services together. In planning Phase 2A, the City of Cape Town (City) has begun to define the role of each provider in a re-imagined, integrated PT network where rail and BRT provide trunk services, contracted bus provides direct services and some higher order feeder routes, and MBTs provide the majority of feeder services as well as some direct services (TDA, 2017).

With the City's intention to use MBTs as feeders to scheduled modes, questions arise as to how these modes could be integrated in some way at the transfer point. An example of the City's envisioned hybrid network currently exists at the Mitchells Plain public transport interchange (PTI); unscheduled MBT feeders bring passengers from surrounding areas and many transfer to scheduled modes to reach their final destinations. However, some issues exist. Previous research has assessed the level of complementarity in Mitchells Plain between MBT feeder/distributor service and scheduled PT trunk service with respect to MBT service span and frequency (Behrens, Hawver, et al., 2017). Issues were

found particularly related to service span, with MBT service ending too early to accommodate later trunk service arrivals, as well as some indication of long wait times for MBT departures during off peak times.

Knowing these two service quality issues, this research develops mechanisms, or interventions, to address them. The feasibility of implementing these interventions is then assessed, focusing on the issues highlighted from the implementation of BRT in Cape Town: resistance from the MBT industry (contributing to the costly and time-consuming transition) and high operational costs to government of the new BRT services. The research intends to assist operators in sharing their perspectives outside of a City-structured engagement process and to assist City officials in understanding what reform paths will be most feasible based on paratransit operator acceptability and cost to the City.

1.2 Objectives

The intention of this research can be broken down into seven research questions:

1. What issues arise when scheduled and unscheduled PT modes meet at a transfer point?
2. What interventions, as alternatives to comprehensive BRT implementation and paratransit assimilation, might address these issues?
3. What interventions to increase service span and/or decrease headways of MBT feeder services in off peak periods are acceptable to drivers?
4. What interventions to increase service span and/or decrease headways of MBT feeder services in off peak periods are acceptable to owners?
5. What will the interventions cost the public authority to sustain?
6. What interventions to increase service span and/or decrease headways of MBT feeder services in off peak periods are most feasible to implement?
7. What implications do intervention feasibility have for policy and regulation?

Question one is addressed in chapter 3 (*Research Context*) where the context of the Mitchells Plain PTI is described and research on the service quality issues identified there are discussed. The process of designing interventions to address these service quality issues are discussed in chapter 5 (*Interventions*). Questions three and four relate to MBT industry resistance; the industry is not composed of a monolithic block of operators, and rather is composed of two main stakeholders: vehicle owners and vehicle drivers (more detail is in chapter 2 *Literature Review*). Therefore, to understand the industry perspective both stakeholders must be engaged (chapters 6 *Drivers* and 7 *Owners*). This research engaged directly with both groups to assess the acceptability of the

interventions to provide an indication of which interventions City officials could successfully pursue at lower cost, both in terms of money and time.

Question five addresses the other key concern stemming from BRT implementation, the ongoing operational costs that have proven higher than expected (chapter 8 *Implementation Feasibility*). Question six then brings the industry perspective and cost together to provide an overall indication of intervention feasibility (chapter 8 *Implementation Feasibility*). Finally, implications for policy and regulation (question seven) are presented in chapter 9 (*Discussion*).

Because each of these questions focus on different aspects of the issue at hand, no one method could be appropriately used to answer all of them. Therefore, a variety of methods are employed to most effectively answer each research question.

1.3 Methods

1.3.1 Research framing

Two research paradigms were espoused by Guba (1978) and Lincoln & Guba (1985): positivism and naturalistic inquiry, though the latter became known as constructivism. The positivist theory of knowledge suggests that phenomena can be explained objectively and with universal laws while constructivism critiques this understanding emphasizing that particular contexts matter (Punch, 2005). Rather than framing the research within one of these two traditional paradigms, this research is firmly framed within the pragmatism paradigm which developed later. This paradigm breaks down the false dichotomy between positivism and constructivism and instead promotes practical empiricism (Johnson & Onwuegbuzie, 2004; Morgan, 2007). The paradigm is characterized by a preference for action over philosophizing and a practical approach to determining what works best in the course of answering research questions (Johnson & Onwuegbuzie, 2004). It also may promote incremental change rather than more fundamental or revolutionary change; coincidentally this aligns with the findings of this research discussed below and in chapters 8 (*Implementation Feasibility*) and 9 (*Discussion*) (Johnson & Onwuegbuzie, 2004).

Accordingly, the methods used in this research were selected based on their practical ability to answer each research question. These methods are mixed, both qualitative and quantitative over phases of the research, aligning with the philosophical leaning of the pragmatism paradigm (Johnson & Onwuegbuzie, 2004). Johnson & Onwuegbuzie (2004) state that "…research approaches should be mixed in ways that offer the best opportunities for answering important research questions." Johnson & Turner (2003) suggest that the fundamental principle of mixed research encourages researchers to

"collect multiple data using different strategies, approaches, and methods in such a way that the resulting mixture or combination is likely to result in complementary strengths and nonoverlapping weaknesses."

Despite the fact that this research uses a naturally-occurring example of the hybrid network, it is not case study research. The issues of PT service quality complementarity in Mitchells Plain have been identified previously; this exploration could have appropriately used a case study method. This research, however, is focused on solutions to those identified issues in a complex, multi-stakeholder environment. As such, I am applying mixed methods because varying methods are most appropriate to answer the research questions which seek to identify feasible interventions to address the service quality complementarity issues. To some degree, components of action research were drawn on; this approach typically focuses on practical application using mixed methods to identify the problem, research causes of that problem, develop solutions, and implement those solutions (Punch, 2005). While the problem has already been identified and I do not continue past the stage of solution development to implementation, the two stages of causal understanding and solution development apply here.

This research could be described as positivist or constructivist in part and in certain components but is never fully contained within either paradigm. Methods used with drivers, choice modeling, is heavily mathematical and is the most positivist component; on the other hand, methods used with owners are somewhat constructivist in that qualitative analysis is undertaken on focus group discussion to gain a thick understanding of patterns and themes within owner perspectives (Punch, 2005). These methods were chosen because they were most appropriate, a key tenet of the pragmatism paradigm as discussed above. Choice modelling allowed assessment of driver willingness to change operations and of costs of each interventions (questions three and five) while focus groups with owners (question four) allowed research to mimic the reality of group decision-making within associations. Feasibility is then assessed by multi-criteria analysis to bring the two perspectives and costs together. Use of different methods for each component of the research allowed an expanded "breadth and range" of understanding (Greene, Caracelli, & Graham, 1989) and a "superior product" (Johnson & Onwuegbuzie, 2004).

The particular context of the Mitchells Plain PTI is important and recommendations are specific to this situation, but there are also lessons that may be transferable to other areas of Cape Town and possibly to other cities in low and middle income countries. Findings are not claimed to be generalizable and should not be. This research seeks to draw lessons carefully, asking "how much of our existing knowledge might be usable in a new set of circumstances, as well as what our warrant is

for making any such claims" (Morgan, 2007). Transferability is a key focus of pragmatist research as opposed to the focus on generalizability in positivist research or the limited nature of conclusions stemming from a specific context within constructivist research (Morgan, 2007).

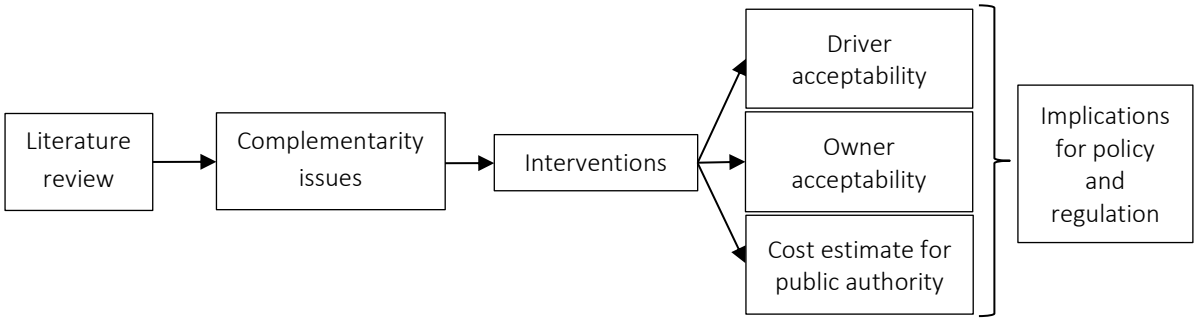
1.3.2 Embedded scholarship

I conducted my research as part of the Embedded Doctoral Researcher Initiative, an agreement between the University of Cape Town and the City of Cape Town's Transport and Urban Development Authority (TDA). The program is funded by the Volvo Research and Educational Foundations (VREF) through the African Centre of Excellence for Studies in Public and Non-motorised Transport hosted in part at the University of Cape Town (UCT). This external funding allows research to maintain academic independence from the City while allowing research to be conducted within the government structure. The goal of the program is to facilitate two-way knowledge transfer between researchers and practitioners to ensure research is practical and disseminated in a timely manner. To enable this, I split time between the university/academic realm and City/practical realm in addition to my engagement with the MBT industry at ranks (the local term for terminals) and in association offices. I was asked to join meetings and discussions when appropriate and communicated lessons from conferences and my research. City officials assisted with intervention design, testing, and refining my approach for owner focus groups, and providing access to information. My interaction with City officials enabled ongoing insight into the planning process across different work groups, informing my research throughout. This research would have been much less robust and likely impossible to complete without this embedded structure. Another key goal of the program is to ensure research is practically useful to practitioners, which aligns with the pragmatism paradigm that emphasizes action.

1.4 Products

The final result of this research is a recommendation of the most feasible interventions to address service span mismatch and long off peak headways when scheduled and unscheduled services meet in a hybrid network. Implications for policy and regulation are discussed along with potential logistical challenges associated with implementing these interventions. To reach this goal of overall feasibility, a number of component findings are presented. These include a set of seven interventions designed using available literature and consultation with experts in the field to address the two service complementarity issues. The driver and owner perspectives are both discussed in detail stemming from the data collection efforts with these two groups. And finally cost estimates are provided for each of the seven interventions. The overview is shown in Figure 1 and will be repeated at the beginning of each chapter as a reminder of how the chapter relates to the other components.

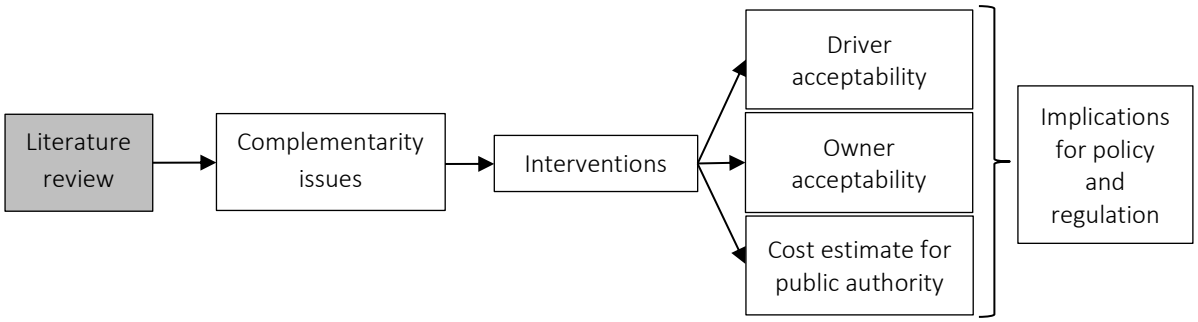
Figure 1. Research overview.



1.5 Organization of thesis

This thesis is presented in 10 chapters, including this introduction. The next, chapter 2 (*Literature Review*), provides background on PT in Cape Town and on the MBT industry and regulatory history before discussing BRT-centered reform, the issues faced, and the reconsideration of the approach. Chapter 3 (*Research Context*) describes the naturally-occurring example of the hybrid network that is the focus of investigation, giving details on the MBT associations involved and about the service complementarity issues between scheduled and unscheduled services at the PTI. Chapter 4 (*Method*) gives an overview of the various methods used to answer the research questions and clearly notes where full method details are provided in later chapters. Chapter 5 (*Interventions*) reviews integration precedents from the literature before describing the process of designing interventions to address service quality issues in Mitchells Plain and concludes by describing each of the seven interventions in detail. The process of designing and administering the SC survey to understand driver perspectives is discussed in chapter 6 (*Drivers*). This chapter also presents findings from that data collection effort. In parallel fashion, chapter 7 (*Owners*) details the focus group method used to collect data with owners and presents findings on intervention acceptability from their perspective. Chapter 8 (*Implementation Feasibility*) first covers the method used to estimate intervention costs and presents those estimates; the second half of the chapter describes the multi-criteria analysis method used to combine driver and owner acceptability of interventions with costs and summarizes the findings of which interventions are most feasible overall. Implications for policy and regulation are found in chapter 9 (*Discussion*). The final chapter is chapter 10 (*Conclusion*) which summarizes each element of the thesis.

2 Literature Review



This chapter contextualizes this research based on available literature, both academic and grey. The academic literature was searched using relevant key terms: paratransit, trunk and feeder, integration, scheduled, unscheduled, public transport reform, hybrid network, transfer, incentive. These terms were used in various combinations, and in total produced relatively limited relevant results. The literature related to paratransit in general is rather limited and often consists of studies describing and assessing the current state of paratransit within particular cities or broader comparative studies considering similarities in operations across them. Research looking specifically at reform and then specifically at reforms related to integrating scheduled and unscheduled PT services at a transfer point are particularly limited. Therefore, resources in the grey literature were relied on as well. These include government reports and plans, working papers from various non-governmental organizations, and scholarly research not formally published through journals and conferences. In addition, presentations by experts during postgraduate courses at the University of Cape Town (UCT) and government workshops were used when appropriate. This research contributes to the academic literature in a small but growing research niche.

In this chapter, the need for PT is highlighted before providing background on the specific services in Cape Town. Information related to paratransit services is discussed next, followed by more specific information on PT reforms in Cape Town and shifts in the intended approach by government. The remainder of the chapter highlights alternative paratransit/PT reform options and the need for this research to identify feasible approaches for Cape Town based on the paratransit industry perspective.

2.1 Cape Town public transport

Mobility is a basic need, often required for accessibility to employment, shopping, entertainment, and friends and family. While this mobility can be obtained in several ways, many rely on PT; in many cities, those who rely on PT include both choice and captive users. In Cape Town in particular, high unemployment and low wages result in a large number of captive PT users whose livelihoods depend

on having efficient and reliable PT (Piek, 2017). In fact, 94 percent of PT users in Cape Town are in low or low-middle income groups, highlighting the equity concerns around failing to invest carefully and efficiently in PT reforms (TDA, 2018b).

Many of these lower income individuals live on the periphery because of apartheid spatial planning but also because more recent government housing policy has favored the production of large numbers of housing units which necessitates construction on inexpensive land often located far from desirable locations and places of employment (Bruun et al., 2016). This effort to inexpensively produce large numbers of housing units is common in cities in low and middle income countries, including in Santiago (Martínez et al., 2017). Unfortunately, this exacerbates the challenges faced by low income passengers which make up 25 percent of the city's population; according to planning analysis, they spend more than 10 percent of monthly income on transport costs (TDA, 2018b). Providing service to distant areas with long average trip lengths is expensive for government as well and is aggravated by highly peaked demand (Clark & Crous, 2002; Scorcia & Munoz-Raskin, 2019).

A highly developed PT system would help address these spatial problems, though in Cape Town the system is instead highly fragmented. Because multiple modes operate on independent fare payment systems, passengers avoid intermodal transfers to avoid paying multiple fares (Bruun et al., 2016). As a result, operators duplicate each other's routes. While this provides options for passengers, it also causes operating inefficiencies as modes compete for passengers and subsidies are provided to both rail and bus operators to provide, at times, similar origin-destination services. Further complication stems from the multiple levels of government involved in PT provision, with national government operating rail, provincial government contracting for regional bus service, and city government contracting for MyCiTi BRT service (Clark & Crous, 2002; TDA, 2018b). MBT regulation is under the purview of provincial government, but City officials are the *de facto* authority for the approval or amendment of operating licenses (TDA, 2014).

In the morning peak period, over half of all trips are completed by private transport, 38 percent by PT, and 9 percent by non-motorized modes (Table 1). Most high income commuters (88 percent) use private transport while only 17 percent of low income commuters do (TDA, 2018b). Within PT, Metrorail has traditionally served a large proportion of passenger demand because it is well-integrated into the built environment (Clark & Crous, 2002), though in recent years ridership has declined significantly with the increase in cancelled trains, delays, and other issues that impact heavily on reliability (De Klerk, 2017; TDA, 2018b). Road-based PT passenger demand is served primarily by MBTs that carry 60 percent of passengers, though some of the declining rail ridership has likely increased this proportion.

Table 1. Cape Town modal split.

Mode	All transport	PT only	Road PT only
Private	53		
NMT	9		
Rail	18	47.4	
Bus	6	15.8	30.0
BRT	2	5.3	10.0
MBT	12	31.6	60.0

Note: "All transport" values from 2015 EMME model as reported in CITP 2018-2023 (TDA, 2018b). Others from author's calculation.

PT travel time in Cape Town is two to three times longer than car travel time, a critical equity issue when PT serves mainly low income commuters (Hitge & Vanderschuren, 2015). Results show the car is the fastest mode of transport, followed by MBT, rail, and bus. As is discussed in the next section (*2.2 Paratransit*), small vehicles used for MBT service are more maneuverable and allow for speeds more similar to private cars than to large buses.

2.2 Paratransit

2.2.1 Background

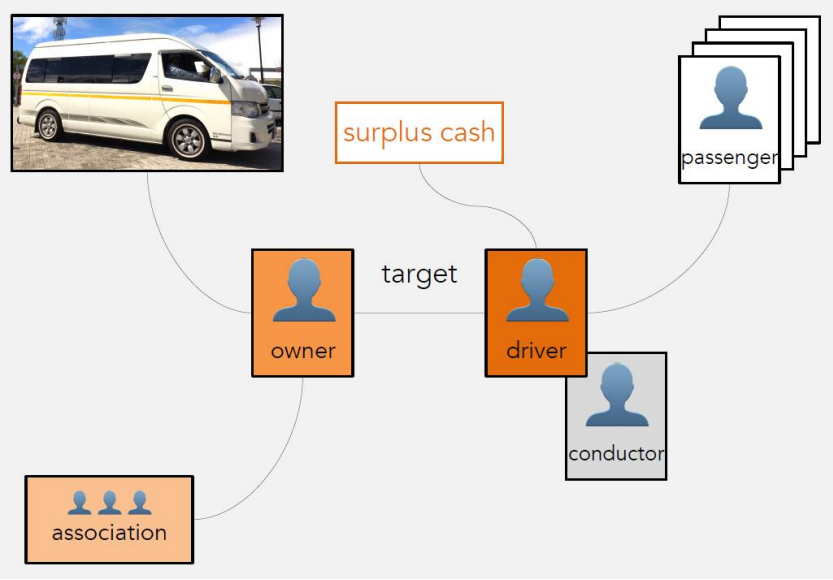
The term paratransit was first used in the United States to describe services that are unscheduled and complement fixed PT (Kirby et al., 1974; Saltzman, 1973), but was later broadened by Cervero (1985) to refer to any transport between private automobiles and fixed PT services, used throughout low and middle income countries to describe privately and independently operated PT services. Local names for these include *jeepneys* (Philippines), *matatus* (Kenya), *danfo* (Nigeria), *trotro* (Ghana), and *car rapides* (Senegal), reflecting the wide range of contexts within which relatively similar services have emerged (Behrens, McCormick, et al., 2016; Cervero, 1985, 2000; Kumar & Diou, 2010; Lau, 1997; Saddier & Johnson, 2018). All are unscheduled transport services that respond to demand in time and space, though because regulation varies considerably by city/country, in particular contexts regulation may restrict this responsiveness to some degree. For a review of paratransit literature since the 1970s, see Behrens, McCormick, et al. (2017). This research uses the definition put forth by Behrens, McCormick & Mfinanga (2016) that describes paratransit as unscheduled PT provided by small-scale private operators within a range of business formality and regulatory schemes.

While these services are sometimes referred to as "informal transport" (Cervero, 2000; Golub et al., 2009), in many cases this is a misnomer as operators are licensed or operate as registered members of legally recognized associations or cooperatives that have rules, hold elections, and promote the interests of members (Behrens, McCormick, et al., 2016). Some scholars have argued that use of the

term informal leads to a dismissal of operators by government regulators, a problematic perspective when in many cities paratransit is essentially the only operational PT (Schwanen, 2018).

In South Africa, paratransit is referred to as minibus-taxis (MBTs), which are mostly 15-seater vans. As in many countries, operator decision-making is divided between two individuals, an owner and a driver (Figure 2). The owner provides the vehicle and is issued an operating license that dictates the specific route on which the vehicle is permitted as well as which ranks can be used for loading (McCormick et al., 2016; TDA, 2014). The owner is responsible for vehicle maintenance and repairs and interacts with regulators regarding licensing, fines, and other items because there is a legal record of vehicle ownership (at least for legally operating vehicles which comprise slightly over half of the fleet in Cape Town (TDA, 2014)). Drivers determine the operational specifics of the service, deciding when to provide service, and often deviate from specified routes based on passenger requests or known demand. Drivers collect fare revenue and either pay owners a rental fee—called a target—each day or split the money with the vehicle owner in a commission setup, where typically 70 percent accrues to owners and 30 percent to drivers (McCormick et al., 2016). Owners are often not involved in the operational particulars of service and simply collect the target or other remuneration and undertake maintenance or repair when necessary. A third individual called a sliding door operator or conductor is, if present, paid from the driver's earnings and is responsible for collecting fares on board. Drivers and conductors are rarely, if ever, members of a labor union. Employment of drivers and conductors is typically informal; very limited instances of signed agreements between drivers and owners exist.

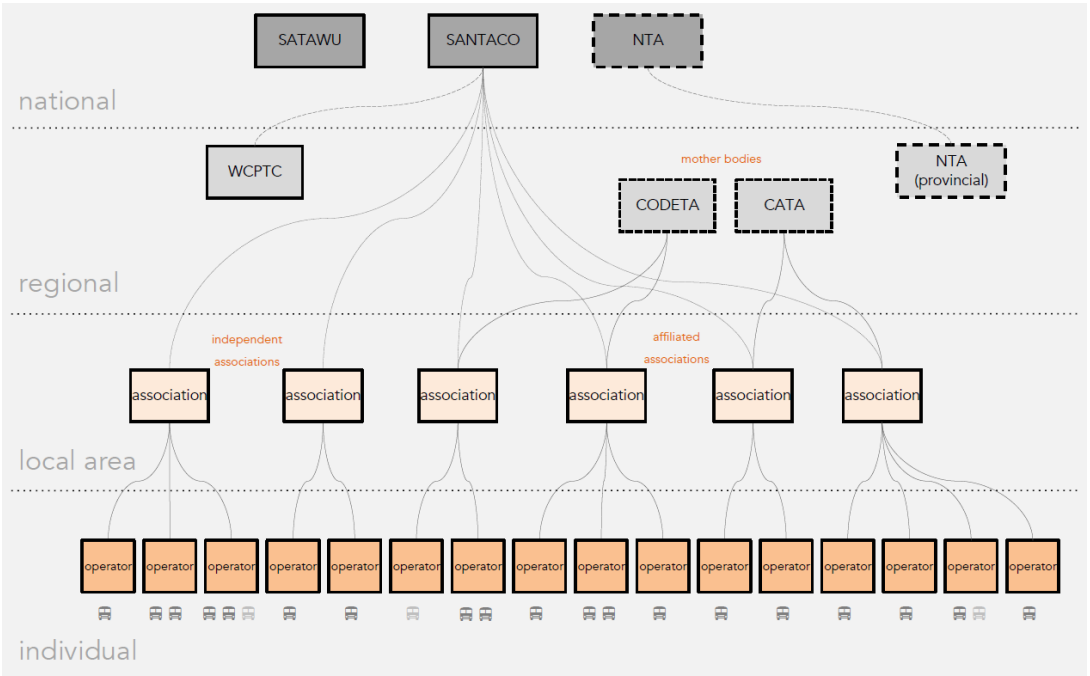
Figure 2. Diagram of MBT operator relationships (Schalekamp, 2017c).



Owners must belong to an association, a body which operates according to rules, and the association must approve any application for an operating license (Figure 3). Associations do provide some regulatory control of the industry by coordinating service at ranks and setting fares, though mainly serve the interests of owners rather than drivers or passengers (Wilkinson, 2008). However, some associations do have mechanisms for handling customer complaints about driver behavior or other aspects of service, with contact information posted inside vehicles.

There are a number of "mother bodies" which supposedly represent the interests of associations, though in many cases this is dubious (Figure 3). These are the Congress of Democratic Taxi Associations (CODETA) and the Cape Amalgamated Taxi Association (CATA) which impose some control on affiliated associations at a regional level, but not all associations are affiliated. The South African National Taxi Council (SANTACO) and the National Taxi Alliance (NTA) supposedly represent operator interests at the national level. However, SANTACO is the only group officially recognized by the government, while the NTA is thought to represent mostly illegal operators (Schalekamp & Behrens, 2010). SANTACO has a layered structure, with associations linked to local councils that link to provincial councils and finally to the national body. However, as is discussed in *2.3.1 Cape Town BRT implementation*, engaging only with these groups on reform is not viable because they do not adequately represent the perspectives of the industry as a whole.

Figure 3. Diagram of wider MBT governance (Schalekamp, 2017c).



MBT services in South Africa and paratransit services more generally play a critical transport role as evidenced by the large proportion of road-based passengers carried, but often this benefit is

overlooked by many in the media and among the public who see only reckless driving. Many of the positive and negative elements of paratransit in South Africa are similar to those in other countries, which are summarized in Table 2. In South Africa, most owners in the industry are Black or Coloured (government racial classifications that originated during apartheid), historically oppressed groups who were often restricted from investing in other businesses; MBT businesses provide a generally low barrier to entry and therefore a path to empowerment (Barrett, 2003; McCormick et al., 2016; Woolf & Joubert, 2013). In a survey of MBT owners in Pietermaritzburg, South Africa, Magubane & Manicom (2003) found that almost 84 percent were Black and 62 percent derived their sole incomes from the business.

Paratransit is often more frequent than scheduled PT, with peak headways measured in seconds rather than minutes, and are more maneuverable in heavy traffic that is commonplace in rapidly growing cities of low and middle income countries (Cervero, 2000). Smaller vehicles provide greater security compared to train carriages because everyone is in view of the driver and often lend a sense of camaraderie as well (Cervero, 2000).

However, disadvantages include unpredictable arrival and departure times for passengers, poor frequency at off peak times, overloading of passengers, aggressive driving, and poorly maintained vehicles (Cervero, 2000; McCormick et al., 2016). Competition between independent drivers in often oversaturated markets is a major cause of these issues, as is the unpredictable pay structure for drivers, where earnings depend directly on how many passengers are carried per day (Cervero, 2000; McCormick et al., 2016). In many cases, and certainly in South Africa, the MBT industry has a fraught relationship with government.

Table 2. Summary of positive and negative elements of paratransit services.

Positive	Negative
• Short access distance/high coverage (Hitge & Vanderschuren, 2015) • Frequent (Cervero, 2000) • Greater security in smaller vehicle (Cervero, 2000) • Customer service, such as older passengers assisted with boarding/alighting • Demand-responsive (McCormick et al., 2016) • Job creation for low-skilled young men (Schwanen, 2018) • Subsidy-free (McCormick et al., 2016)	• Poorly maintained vehicles (Cervero, 2000) • Poor off peak frequency (McCormick et al., 2016) • Aggressive driving stemming from insecurity of pay (McCormick et al., 2016) • Overloading of passengers (Cervero, 2000) • Passengers unable to board full vehicles near ranks (McCormick et al., 2016) • Informal driver employment results in unpredictable income and job security and no benefits (McCormick et al., 2016)

2.2.2 Regulatory history in South Africa

The characteristics of the MBT industry are rooted in more general market conditions that are common in other countries, but also to the specific context of South Africa and its complicated past. An early version of the MBT industry developed by providing rides, for a small fee, to passengers unable to board over-full state-owned PT that instituted segregated services heavily favoring capacity for Whites (Woolf & Joubert, 2013).

Transport challenges grew with the implementation of spatial segregation stemming from the Group Areas Act of 1950 (Mesthrie, 1993) which forced Black and Coloured South Africans to the periphery of cities (Clark & Crous, 2002). While subsidized transport services were provided by the state to allow workers to travel to places of employment, other transport needs were ignored (Clark & Crous, 2002). The MBT industry grew to serve community needs for non-commute transport and provide an alternative to subsidized bus and rail services (Bruun et al., 2016) that failed to provide adequate services. As service became increasingly expensive to provide, service coverage and frequencies declined (Barrett, 2003), opening the door to MBT industry growth. Exemplifying Gwilliam's (2008) regulatory cycle, competition from MBTs led to calls for regulation of the industry to reduce competition with subsidized modes (McCormick et al., 2016).

In 1977, the Road Transportation Act enshrined into law the Van Breda Commission's recommendations from the previous year that effectively deregulated paratransit market entry by requiring that only vehicles with nine or more seats require an operating permit, when previous legislation defined this number as more than four seats (Bruun et al., 2016; Schalekamp & Behrens, 2010). As a result, so-called "combi-taxis" were able to operate legally for the first time. However, it remained difficult to obtain a permit so many larger vehicle operators continued to provide services illegally (Schalekamp & Behrens, 2010).

Competition regulation policy then underwent a pendulum swing: starting with the Welgemoed Commission which recommended the protection of incumbent bus companies by the phasing out of "combi-taxis," moving to a National Transport Policy Study which recommended granting operating permits to illegal "minibus-taxis" carrying 16 passengers; and ending with a Transport Deregulation Act of 1988 which precipitated an exponential increase in the issuing of operating permits (Bruun et al., 2016; Schalekamp & Behrens, 2010). The South African Black Taxi Association (SABTA), the voice of the MBT industry at the time, warned prior to the Act's passage that deregulation would be problematic while also suggesting that deregulation was a government scheme to destroy the industry after operators had begun to build wealth (Woolf & Joubert, 2013). Some warning signs were already present since the dissolution of the railway police in 1986. The Road Transportation Act of

1977 had tasked the force with enforcing PT permits, and with their dissolution, little enforcement was occurring (Woolf & Joubert, 2013). As a result, taxi operators took matters into their own hands to limit competition from illegal operators; often this self-regulation led to violence (Woolf & Joubert, 2013). Indeed, SABTA's warning proved prescient. Between 1984 and 1989, deregulation led to a 2500 percent increase in issued MBT permits (Khosa, 1992) and by 1989 MBTs were carrying the largest proportion of PT passengers (Schalekamp & Behrens, 2010). The violence that had been occurring since 1986 increased dramatically as the industry reached saturation, eventually earning the name "taxi wars" (Barrett, 2003).

With an obvious need for intervention, the National Taxi Task Team was formed by the post-apartheid government in 1994 to consider solutions. Recommendations made in the White Paper on National Transport Policy of 1996 included formalizing MBTs through the formation of associations and shifting to a route-based licensing structure that was intended to provide clearly defined and separate operating areas for MBT associations (Schalekamp & Behrens, 2010; Woolf & Joubert, 2013). To promote formalization of business and employment practices, the government introduced the Taxi Recapitalization Program (Wilkinson et al., 2009); however, the formalization component of the program has mostly fallen away, leaving only the fleet renewal portion that offers a partial capital subsidy for new vehicles contingent on scrapping older vehicles (Wilkinson et al., 2009). While the recapitalization program has resulted in the removal of old and often unsafe vehicles, the impact of the program has been more limited because the capital subsidy covers only a quarter of new vehicle cost (Schalekamp & McLachlan, 2016) and in general, limited progress had been made in formalizing the MBT industry.

2.3 Public transport reform

2.3.1 Cape Town BRT implementation

Stemming from the lack of progress in reform and to address deficiencies in PT generally and related to the MBT industry more specifically, and spurred by the announcement that South Africa would host the 2010 FIFA World Cup, in 2006 the Integrated Rapid Public Transport Network program was launched by national government to promote the implementation of BRT (Schalekamp & Behrens, 2010) (National Department of Transport, 2006, 2007). Branded MyCiTi in Cape Town, the new BRT system would incorporate existing MBT drivers in the areas where BRT would replace them to ensure that employment opportunities remained constant (City of Cape Town, 2007; Schalekamp & Behrens, 2013; Schalekamp & McLachlan, 2016; Siyongwana & Binza, 2012). To do this, MBT operators were formed into vehicle operating companies (VOCs) that would negotiate 12-year contracts with the City

for MyCiTi operations (Schalekamp & McLachlan, 2016). However, negotiations for these contracts were continually delayed, forcing the City to use interim contracts to ensure services were running for the World Cup (Schalekamp & Behrens, 2010). Formation of three VOCs took six years from first survey to commencement of 12 year contracts (Schalekamp & McLachlan, 2016).

There were many reasons for delays in negotiation (for more details, see Schalekamp & Behrens (2010) and Schalekamp & McLachlan (2016)), not least of which is the historical distrust of government among members of the MBT industry. In the past, SABTA saw deregulation as a government attempt to destroy the industry; similar sentiments were felt during this reform process where industry felt that City officials were not making enough guarantees of employment opportunities, providing enough ownership opportunities, or acknowledging the important role of the industry in economic empowerment and the pride that operators take in their work (Schalekamp & Behrens, 2010; Schalekamp & McLachlan, 2016; Woolf & Joubert, 2013). In addition, initial engagement with operators was through SANTACO, which is only theoretically representative of the MBT industry. Through extensive interviews with operators in Cape Town, it is clear that operators preferred to be engaged directly as each is essentially an individual business owner only loosely connected to others through registered associations (Schalekamp & McLachlan, 2016).

The process of industry transition proved problematic due to resistance from MBT operators, but also from difficulties around MBT operating licenses. The National Land Transport Act prevents cancellation of MBT operating licenses, forcing planners to incentivize MBT operators to give up their right to provide services along the routes MyCiTi would take over to ensure MyCiTi encountered minimal competition from MBTs (National Land Transport Act Regulations, 2011). Compensation values were determined by surveying fare revenue on affected routes and engaging with associations to agree upon costs. Taking the difference between these values and multiplying by seven years (the duration of an operating license) provided the compensation amount to be paid (Schalekamp & McLachlan, 2016). This value was either paid to operators who chose to exit the transport industry entirely, or converted into shares in a VOC. Additional compensation came from the scrapping of MBT vehicles. In exchange for compensation, operators agreed to have their license cancelled and never operate in the area again. Each operating license cost an average of one million Rand, which the City quickly realized was unsustainable (Business Planning Branch, TDA, 2017; McLachlan, 2010).

In addition to issues with the reform and engagement process, the resulting BRT system has required much larger operational subsidies than expected (TCT, 2015; Von der Heyden et al., 2015). BRT in South Africa generally was initially touted as a PT solution that would not require subsidies (Schalekamp & McLachlan, 2016). Some Latin American BRT systems are run without an operating

subsidy (Sandoval & Hidalgo, 2002), but this is rare and the MyCiTi system is no exception (TCT, 2015; Von der Heyden et al., 2015). Unfortunately much of the explanation lies in apartheid spatial planning and its persistent effects on land use segregation and sprawling, low density development (Behrens & Salazar Ferro, 2016).

High quality PT is expensive to provide; frequent services require a large fleet and many employees. To recover costs while keeping fares affordable, passenger demand must be high throughout the day and across the network. Low density development, unidirectional travel, and a high peak-to-base ratio (Cooke et al., 2018; TCT, 2015) in Cape Town essentially guarantee that PT, outside of key trunk corridors, will require an operational subsidy. This situation is not unique to Cape Town; a similar situation exists in Johannesburg (Scorcia & Munoz-Raskin, 2019). Indeed, MyCiTi services in September 2017 were recovering approximately 46 percent of operating costs from revenue (both fare and other such as advertising) (A. Bulman, personal communication, 1 October, 2018), while most MyCiTi feeder services generally operate at a greater loss (TCT, 2015). Nelson Mandela Bay's starter BRT service, which includes both trunk and feeder service, is recovering 28 percent of operating costs in November 2018 and only ever expects to recover 35 percent (Mitchell, 2018).

2.3.2 The hybrid shift

Because of the issues encountered through rollout of initial MyCiTi services, City officials have reevaluated the approach for future phases of BRT implementation, clearly stating in the 2017 Integrated Public Transport Network Business Plan that "the Phase 1 methodology is not viable or sustainable" (TDA, 2017). The intention is to design a hybrid PT network that uses both scheduled and unscheduled services together. In planning Phase 2A, the City has begun to define the role of each provider in an integrated PT network where rail and BRT provide trunk services, contracted bus provides direct services and some higher order feeder routes, and MBTs provide the majority of feeder services as well as some direct services (TDA, 2017). This aligns with earlier calls for MBTs to act as complementary partners for PT provision (Behrens, Salazar Ferro, et al., 2016; Salazar Ferro et al., 2013) and suggestions that future PT development in Cape Town should seek to replace MBTs in fewer situations while also engaging in incremental reforms with the MBT industry (Hastings, 2017)

There is evidence to support the use of MBTs as feeders to scheduled modes. In a comparison of passenger satisfaction for various modes in Cape Town, it was found that MyCiTi feeder passengers are very highly satisfied. However, passenger satisfaction among those riding MBT feeder routes was only somewhat lower (Behrens et al., 2018). This suggests that MBTs can provide acceptable feeder service with a comparable level of passenger satisfaction, though it is interesting to note that the same association involved in the Taxi Operating Company (TOC) pilot was also included in this

passenger satisfaction survey; the TOC pilot resulted in increased passenger satisfaction as discussed below, suggesting that satisfaction is subject to expectations and experiences (Saddier et al., 2019).

Additional evidence of paratransit providing high quality of service comes from research in Accra, Ghana that found lower than expected variability in headways and travel time in paratransit operations (Saddier et al., 2017). Overall, 72 percent of routes showed standard deviations of less than 10 minutes in total travel time, suggesting that paratransit can and does provide reliable services despite contending with congestion. Using MBTs as feeders also takes advantage of a key strength, namely frequency; for short distance travel, waiting time makes up a large portion of total travel time and MBTs generally provide more frequent services than scheduled modes, reducing wait time and therefore total travel time considerably (Van Ryneveld, 1989). In surveys of Gauteng commuters, BRT passengers expressed a desire for higher frequency, which MBTs have the potential to deliver (Hayes & Venter, 2017). A key challenge for a trunk and feeder system in a fragmented system is that passengers must pay separately for each leg; the ideal solution would include an integrated fare payment system that reduces the transfer cost for passengers (Venter, 2016).

2.3.3 Paratransit integration

With the City's intention to use MBTs as feeders to scheduled modes, questions arise as to how these modes could be integrated in some way at the transfer point. First, however, it is worth reviewing some other potential integration forms explored by Behrens, Salazar Ferro & Golub (2016) and Ferro & Behrens (2015).

One method is termed peak lopping and would utilize MBTs on a trunk route to provide peak-only service while the scheduled BRT service provides service throughout the day (Behrens, Salazar Ferro, et al., 2016). This arrangement reduces the BRT fleet size requirements, and therefore capital and operating cost, to the City while maintaining a role for paratransit operators on the same corridor. During the off peak, operators could provide chartered travel or employee transport services. Other arrangements include shared roads, where paratransit operates in mixed traffic while scheduled services operate in dedicated rights of way on the same road (Behrens, Salazar Ferro, et al., 2016). Shared busways could amend this somewhat to allow all PT services access to the dedicated right of way (Behrens, Salazar Ferro, et al., 2016). This approach has been used in Delhi, but only after major opposition arose to the implementation of an exclusive BRT lane; it has since been discontinued entirely. In a parallel roads arrangement, paratransit and BRT or bus operate on separate, parallel roads in the same corridor (Behrens, Salazar Ferro, et al., 2016).

Salazar Ferro et al. (2012) find that, of these approaches, a trunk and feeder arrangement is conceptually a promising way to integrate paratransit because it allows vehicle types to be well-matched to demand. Del Mistro & Bruun (2019) suggest that, by aggregating trunk demand from multiple feeders, all-day service is more financially viable than direct services and modeling indicates that trunk and feeder systems use less energy than direct services. In Cape Town, trunk routes would be provided by higher capacity BRT or bus while feeder routes would be provided by MBTs (TDA, 2017). Appropriate stop spacing and higher operating speeds can be achieved on trunk routes with prioritization measures while feeder routes are shorter and can provide more door-to-door service, all while avoiding destructive competition that could arise from shared roads, shared busways, and parallel roads. There is some concern that such a system introduces too many transfers and too much rigidity as in Santiago before subsequent adjustments (Salazar Ferro & Behrens, 2015) and it is clear that Gauteng BRT passengers want fewer transfers (Hayes & Venter, 2017). A major benefit of BRT systems, namely travel time savings, can be negated if transfers are introduced into networks that previously had direct routes (Hook & Howe, 2005). However, some of these issues can be addressed through careful network planning and by using, for some routes, a trunk and branch BRT design that allows one vehicle to provide feeder and trunk service to eliminate transfers.

Peak lopping may also be promising, though more work is needed to understand if operators could remain viable by providing different services during off peak periods (such as charters). It may be difficult to make a convincing case that paratransit operators will not be worse off under the new setup and it will be difficult to enforce (Stoy, 2015).

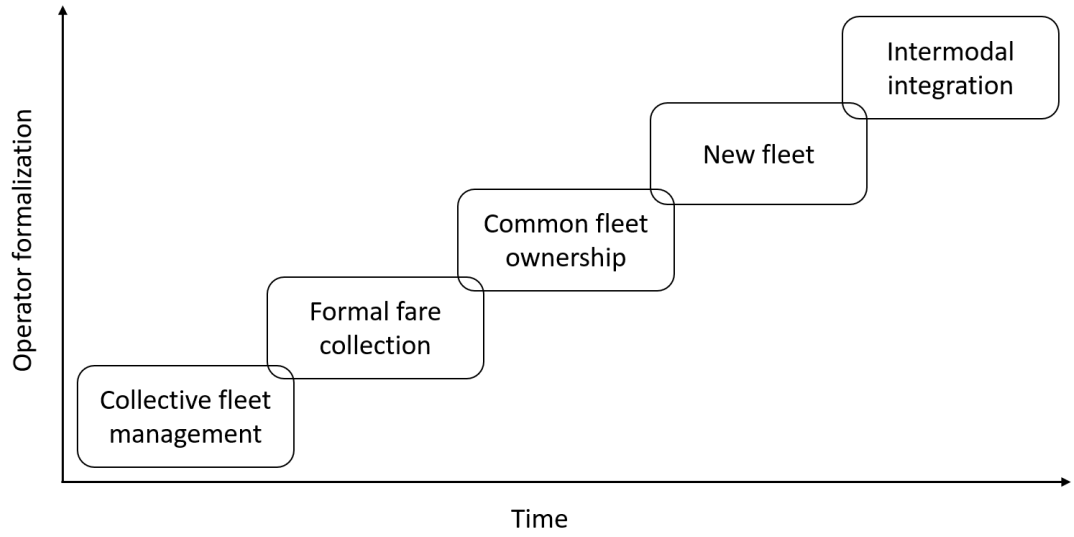
There is clear support for research investigating mechanisms for trunk and feeder integration in the literature and because the City has indicated that such hybrid networks are the intended approach for future PT reform efforts.

2.4 Alternative approaches to paratransit reform

Stepping back from reforms directly related to trunk and feeder networks, scholars have identified alternative approaches to paratransit reform partly because of the difficulty and expense of BRT implementation. Schalekamp & Behrens (2010) identify two, comparing these two alternatives to that used by many cities, which they term comprehensive BRT implementation and paratransit assimilation. The first alternative is termed stepped, flexible transition to bus system improvement and paratransit integration as articulated by (Browning, 2001) where paratransit operators are supported by government to form operating companies with interim management contracts. Owners would retain individual ownership of vehicles, but the company would manage them; if the

arrangement fails, operations can revert to the status quo. If successful, however, further changes would be made including formal cashless fare collection (CFC) by a third party, company vehicle ownership, and eventual fleet adjustment to match demand. The final step in the process would be to integrate with existing or new scheduled modes. The process is summarized in Figure 4, though reform could take a variety of paths.

Figure 4. Stepped, flexible transition (adapted from Schalekamp, 2017).



A somewhat similar approach is being used for the City's TOC pilot where facilitators, lawyers, and PT operations experts were contracted by the City to work with associations to implement scheduled services for two months to determine whether existing associations could provide improved services (Saddier et al., 2019).

One association previously self-organized centralized fueling for individually owned vehicles via a fuel supply contract that provides a discount relative to retail prices. Fuel pumps are located at a jointly-owned depot where vehicles are parked overnight. In addition, some owners had a cash management system that required drivers to pay fare revenue into association staff who then deducted costs for fuel and paid drivers a set percentage of gross revenue before paying the vehicle owner the remainder. Owners remained responsible for maintenance. The payment process and structure was expanded to include all owners in the association for the duration of the pilot.

Existing routes were optimized and additional routes were added based on passenger boarding and alighting surveys completed during the pilot planning process. These routes were operated on a schedule, with drivers scheduled in eight hour shifts each day. Drivers were paid weekly according to hours worked (Saddier et al., 2019). By limiting drivers to eight hour shifts, working conditions for drivers improved.

Dispatchers and route controllers kept records of trips completed and on time performance at the terminus as vehicles continued to board and alight passengers at any point along the route. Vehicle trackers and passenger surveys were used to assess pilot outcomes. Fares continued to be paid in cash despite plans for CFC; this proved too expensive to develop for a two month pilot. Results from a passenger satisfaction survey undertaken both prior to the pilot and during the period when scheduled services were operated shows considerable improvements in passengers satisfaction on all criteria measured, including waiting time, comfort in the vehicle, and vehicle crew attitude, among others (Saddier et al., 2019). In addition, scheduled services eliminated the need for large numbers of vehicles and crew to wait at the rank which passengers stated increased their feeling of safety and security.

This structure is an example of the first step of the stepped approach, collective fleet management. Future plans for the TOC concept include a progression through the remaining steps, from implementing CFC, to transferring ownership from individuals to the company, and finally to recapitalizing the fleet and integrating with other modes including subsidized bus, rail, and BRT.

Two additional examples of the stepped, flexible approach come from Faisalabad, Pakistan and Nairobi, Kenya, though in neither case was the reform conceptualized in terms of this framing as both occurred prior to publication of the paper defining these alternative approaches.

In Faisalabad, PT was first provided by the Punjab Road Transport Board and services were generally frequent and provided good coverage (Khan & Hassan, 2003). However, services declined because of a lack of government support coupled with deregulation in the 1970s, leading to the eventual termination of services in 1990 (Imran, 2009; Khan & Hassan, 2003). Paratransit provided by 10-seater Suzuki pickups filled the gap (Khan & Hassan, 2003). The paratransit mix in Faisalabad includes six seater motorcycle rickshaws and 10-seater Suzuki pickups that operate on semi-fixed routes as well as large 50-seater buses that operate longer distances and are overcrowded during peak periods (Khan & Hassan, 2003). Like Nairobi, there are no road-based government-provided PT services.

To improve PT services, the Faisalabad Urban Transport Society (FUTS) was formed in 1994 as a government-organized non-governmental organization. It is registered as a Voluntary Social Welfare Agency, meaning that it must work for the benefit of its members and to some degree the community at large (Khan & Hassan, 2003; Russell & Anjum, 1999). Led by a commissioner, it also has a governing board consisting of government officials as well as members of FUTS who are vehicle owners (Russell & Anjum, 1999).

FUTS does not own any vehicles as a group but rather sources all vehicles from its members. A signed agreement between owner and FUTS dictates vehicle size (15 seats) and type and operational rules; the owner agrees to cede control of the vehicle for collective management yet retains ownership (Russell & Anjum, 1999; Sohail et al., 2004). Services are unscheduled, leaving termini when full, though sometimes vehicles will leave sooner if drivers notice many waiting passengers on the route during previous in-bound trips (Khan & Hassan, 2003).

The society rotates vehicles across routes to ensure relatively equal earnings per vehicle (Khan & Hassan, 2003). In addition, newer entrants to FUTS are allocated routes where there are fewer FUTS vehicles already operating and generally limit the total number of vehicles, thereby reducing the potential for destructive competition (Russell & Anjum, 1999; Sohail et al., 2004). FUTS also employs route inspectors to enforce rules against overloading, poor driving, and use of undesignated stops along the route (Russell & Anjum, 1999). By agreement with government, FUTS operators are supposed to be regulated only by FUTS inspectors and not the police (Sohail et al., 2004). Likewise, FUTS determines how many licenses are needed for operations and the licensing body, the Regional Transport Authority in the provincial government, mostly rubber stamps such applications (Khan & Hassan, 2003).

While literature detailing FUTS is dated, a recent internet search finds some evidence that the organization remains functional including a newspaper article ("Modern Bus Terminal on the Cards in Faisalabad," 2011), a government report (*Faisalabad Peri-Urban Structure Plan*, 2014), and a job posting (*Administrator FUTS Required in Faisalabad Urban Transport Welfare Society*, 2018)

A final example of the stepped, flexible approach comes from Nairobi. All PT in Nairobi is unscheduled (McCormick et al., 2016) except for recent entrants providing small-scale, premium services that rely on smartphone app technology and are therefore not mass-market services (Chege, 2019; Wainainah, 2019). Paratransit here is referred to as matatus and range in size from 14-seater Toyota Hiace vans to 52-seater buses, though many vehicles are midibuses with 25 to 37 seats. Historically these have operated as individual businesses; however, since a 2010 Transport Licensing Board rule, licenses are only issued to operators affiliated with either a Savings and Credit Cooperative (SACCO) or a transport management company (TMC) (Behrens, McCormick, et al., 2017; McCormick et al., 2013). TMCs have not been widely explored as a mechanism for improving paratransit services, with the exception of work by Opiyo (2002) describing the Kenya Bus Services (KBS) example and wider studies of PT business strategy and level of organization (McCormick et al., 2013) and PT competitiveness (Mbugua, 2009). More recently, Plano (Under review) explored the TMC model and its potential for paratransit

service improvement, finding that it is a valuable model. The description of the TMC is drawn from that paper and the interviews conducted to support it.

TMCs operate like a franchise, where the company owns only a portion of its fleet and individual vehicle owners supply the company with additional vehicles after buying the right to use the company brand (McCormick et al., 2013). Franchisees must comply with company standards for buses, operations, and money management and mostly cede operational control to the company. Cash fare revenue is collected by the crew, which is employed on a salaried basis by the company. The company takes a percentage of gross daily revenue for the services provided in managing the vehicle on behalf of franchisees. The management fee covers the cost of route inspection (to ensure proper driving and reduce ticket fraud by the crew), performance tracking, discipline of drivers and conductors and vehicle cleaning, dispatch, and fueling. The company ensures that vehicles are fueled and charges the franchisee for the amount used; the remainder of the daily revenue is paid to the franchisee as profit, though he/she is still responsible for vehicle maintenance using this money. Fuel discounts have been obtained by two companies (Plano, Under review).

Collective fleet management, the first step in the stepped approach, is evident with the TMC model. Operations managers ensure buses are rotated between more and less profitable routes so franchisees earn equally while individual owners have no role in bus scheduling or routing. The companies also manage crew, scheduling them for work four or five days per week. Franchisees do have some ability to recommend crew or request a poor driver to be exchanged for another, though the company seems to have the final say in this regard. Vice versa, drivers can also request to change vehicle/owner if they are unhappy with the franchisee. While one company interviewed manages vehicles to ensure regular headways by route, the other operates similarly to paratransit by departing termini when full. However, both companies have trackers fitted on all vehicles and a control center that allows for performance monitoring and some operational control via route controllers and dispatchers on the ground (Plano, Under review).

The stepped, flexible approach to reform is one alternative to comprehensive BRT implementation and paratransit assimilation. The second alternative approach is termed incremental existing operator upgrade; advocates of this approach suggest that paratransit services are unfairly maligned and that improved enforcement of operator areas, vehicle safety, and labor practices can lead to improved operations. The City has engaged in some incremental reforms including provision of infrastructure at both major and minor paratransit termini, including large sheltered loading areas, toilets, meeting rooms/offices, and holding areas for vehicles (Schalekamp & Klopp, 2018). This improves the passenger experience compared to previous arrangements where vehicles sometimes loaded in dirt

lots with no shelter, as was the case in Mitchells Plain prior to major investments in 2006 (Graham & Anthony, n.d.).

On the road, dedicated lanes for PT on the N2 freeway in Cape Town are open to both subsidized bus and paratransit vehicles. This improves quality of service for paratransit passengers without long-term funding implications beyond standard road maintenance.

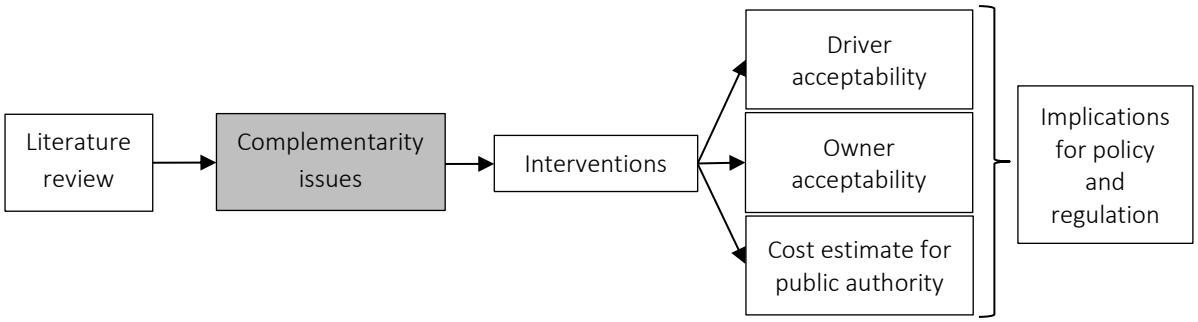
At the national government level, the Taxi Recapitalization Program was initiated partly to promote formalization of paratransit business and employment practices though in reality serves only as a fleet renewal program (Wilkinson et al., 2009). This remains a valid program that has removed old and often unsafe vehicles, though a larger capital subsidy would encourage more operators to take advantage of the program (Schalekamp & McLachlan, 2016).

Because the incremental approach "warrants closer inspection," this research has explored a number of incremental interventions that could be used to address quality of service issues (Schalekamp & Behrens, 2010). These interventions and a series of incremental examples from other cities globally is discussed together in chapter 5 (*Interventions*).

2.5 Summary

This chapter reviewed the literature surrounding PT challenges faced in Cape Town which government attempted to address through BRT implementation; the implementation process has been costly and time-consuming and has resulted in a PT system that requires higher subsidy than intended. Stemming from these issues, the City has re-evaluated the approach to PT reform and is planning for a hybrid network which will utilize MBTs as providers rather than seek to replace them. Scheduled and unscheduled services will coexist and this highlights issues of how best to integrate the two to provide quality services for passengers. Chapter 3 (*Research Context*) describes the naturally-occurring example where the investigation focuses. Interventions to ensure service complementarity between scheduled and unscheduled services are developed and explored with the MBT industry to document their perspective which was lacking in the first phase of BRT implementation. Chapter 4 (*Method*) then provides an overview of the methods used to understand the industry perspective and chapter 5 (*Interventions*) introduces the interventions that are intended to improve MBT quality of service. Results are then presented in chapters 6 (*Drivers*), 7 (*Owners*), and 8 (*Implementation Feasibility*).

3 Research Context



Because of the difficulty in corporatizing and negotiating contracts for service provision in Phase 1 due to resistance from operators, it is clear that operators must be engaged to reduce resistance and/or understand how to avoid such resistance to reform. Operators should be engaged directly, rather than through supposedly representative bodies such as SANTACO (chapter 2 *Literature Review*) (Schalekamp & McLachlan, 2016). As discussed in chapter 2 (*Literature Review*), MBT operation is typically divided between owners and drivers; both must be meaningfully engaged because any interventions in the industry, such as a change in fare payment system from cash to cashless "impacts on the whole business model and relations between operators, labour and passengers" (Schalekamp, McLaren, & Behrens, 2017).

Consequently, this research engaged with both drivers and owners in the industry to understand their differing perspectives on a set of reform interventions regarding service complementarity in a hybrid PT network. The result, discussed in chapter 8 (*Implementation Feasibility*), is an indication of which reforms have the greatest chance of success were the City to attempt to implement them. This approach aligns with the recommendation by Woolf & Joubert (2013) to recognize the grassroots and heterogenous nature of the MBT industry.

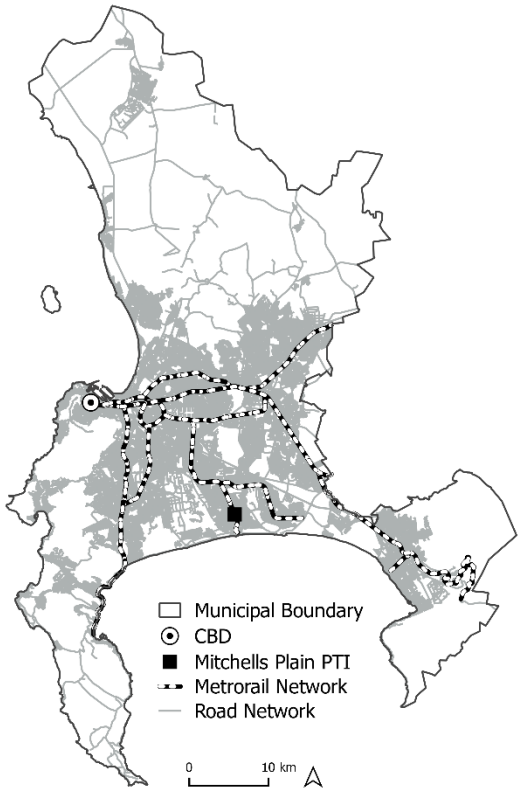
Research shows that the lack of service complementarity between scheduled and unscheduled modes that will be described later in this chapter may already be a considerable problem in Cape Town because of the fairly high number of MBT routes classified as feeders to large PTIs, indicating that these two mode types meet. K-means cluster analysis of MBT tracking data shows that 50 percent of paratransit routes sampled are short distance (mean of 6 km) and have high stop densities (mean of 1 stop/km); within this 50 percent of routes, 44 percent (or 22 percent of all routes sampled) originate or terminate at one of the 10 busiest public transport interchanges (PTIs) in Cape Town (Du Preez et al., 2019). This suggests that solutions to the issue of complementarity between unscheduled feeders and scheduled trunk services is already an important question to investigate and will likely only

become more important as scheduled BRT services are implemented within the hybrid framework as the City has indicated (*2.3.2 The hybrid shift*).

Therefore, the goal of this research is to identify feasible reforms—as alternatives to the Phase 1 approach—by talking to both MBT drivers and owners in a particular case in Cape Town that exemplifies the current and future challenges of mode complementarity in a hybrid PT network. This research seeks to identify which reforms are likely to align services between scheduled and unscheduled PT in the late evening using the Mitchells Plain PTI (Figure 5), one of the 10 busiest interchanges, as the primary basis for such an investigation. MBT operators currently provide unscheduled feeder services to scheduled trunk routes at this location, mirroring the hybrid network arrangement as espoused by the City and providing an opportunity to test the feasibility of interventions to improve transfer quality and hybrid complementarity using a naturally occurring example.

This chapter describes the history and characteristics of each of the areas included in this research, covering sociodemographic characteristics of the populations, the extant PT services, and issues with current service complementarity in both the primary and secondary areas investigated.

Figure 5: Location of Mitchells Plain PTI relative to Cape Town CBD.



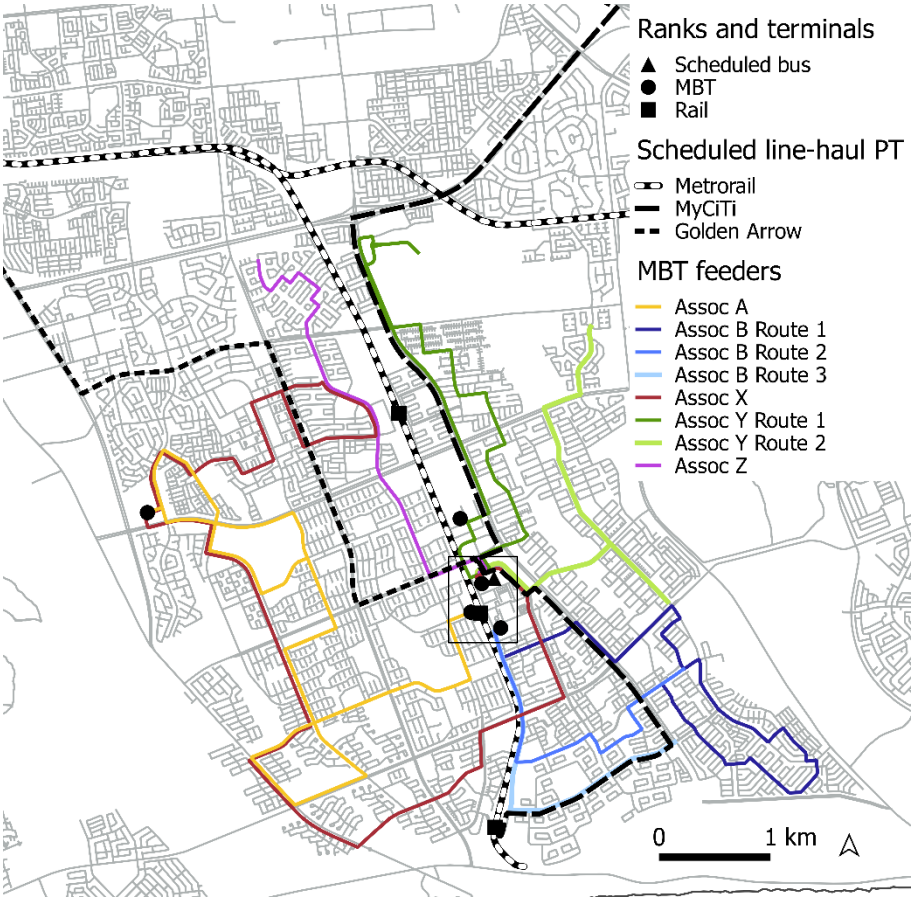
Source: Author using City's Open Data Portal, https://web1.capetown.gov.za/web1/opendataportal/Default.

3.1 Primary case description

Mitchells Plain was built starting in 1974 and was planned to provide housing for 250,000 people by 1984 (Brand, 1980). The area developed in conjunction with the Central railway line that served to connect residents to major employment centers; rail service began on 17 July 1980 (Brand, 1980; de Bruin, 2016). Mitchells Plain is the largest Coloured township in Cape Town with nine neighborhoods of mostly low and middle income residents (Smith & Hanson, 2003). According to the 2011 census, the total population of the area is approximately 310,000 of which nearly 95 percent live in formal dwellings (Statistics South Africa, 2018). Because feeder-trunk-distributor schemes are often implemented with feeders/distributors in low to middle income residential areas, Mitchells Plain is an appropriate location to investigate (Behrens, Salazar Ferro, et al., 2016).

Located 27 kilometers south-east of the Cape Town Central Business District (CBD), the PTI is one of the busiest in the city, serving more than 20,000 passengers per day (TDA, 2018b). The PTI serves as a major transfer point for local and line-haul services provided by Metrorail, Golden Arrow Bus Services (GABS), MyCiTi, and MBTs (Figure 6, images in Figure 7). The area around the PTI is also a destination in its own right for retail and employment at the Town Centre. Another major retail and employment hub, the Liberty Promenade Mall, is located nearby and is linked by MBT service to the PTI.

Figure 6. Public transport routes around the Mitchells Plain PTI.



Note: Bounding box indicates the Mitchells Plain PTI.

Figure 7. Images of scheduled PT modes in Cape Town.

Sources: Metrorail (https://commons.wikimedia.org/wiki/File:Wikimania_2018,_Cape_Town_(P1050610).jpg), GABS (https://townpress.co.za/2019/05/golden-arrows-finalizing-plans-to-beef-up-bus-security/), MyCiTi (author).

Two associations agreed to participate in this research, Association A (Assoc A) and Association B (Assoc B)[1]. Characteristics of each association are listed in Table 3. Assoc A is led mainly by two individuals and charges ZAR 7 per trip while Assoc B is led by committee and charges ZAR 8 per trip (fares given for 2017). Assoc B is larger by vehicle and driver count despite the fact that some owners were previously compensated for OL withdrawal upon implementation of the N2 Express MyCiTi service that runs between the Mitchells Plain Town Centre and the CBD which overlaps some of the association's routes.

Assoc B operates multiple routes, whereas Assoc A has consolidated licensed routes into a single community circulator. All routes across both associations begin and end at the PTI. Two characteristics suggest Assoc A route profitability is lower than that of Assoc B (Table 3). The first is the large proportion of older and/or less expensive vehicles at Assoc A. CAM is a Chinese

[1] Association B was willing to be identified in this study as the Seventh Avenue and District Taxi Association.

manufacturer that retails vans for much less than the Toyota equivalent while Hiace and Siyaya are older Toyota models. The second characteristic is the higher proportion of owner-drivers at Assoc A; by combining the role of driver and owner in one individual, all revenue remains with a single individual rather than being split between two.

Both associations experience fluctuations in demand based on time of month, with higher demand when salaries and South Africa Social Security Agency (SASSA) benefits are paid. Demand is also dependent on the reliability of Metrorail service; with the recent deterioration in service, demand for local feeder and distributor service provided by MBTs has declined as commuters use other modes (De Klerk, 2017).

Table 3. Characteristics of Assoc A and Assoc B.

Characteristic	Assoc A	Assoc B
Member count	31	26
Leadership	Two individuals	Committee
Drivers/owner-drivers	45	78
Percent drivers (v. owner-drivers)	78%	100%[1]
Routes as operated	1	3
One way route average distance (km)	7.0	5.5
Flat fare in 2017	ZAR 7	ZAR 8
Pay system	Target	Commission
Percent CAM/Siyaya/Hiace vehicles	68%[2]	6%[2]

Notes:
– All data from unstructured data collection through conversations with operators unless otherwise noted.
– [1] Based on survey responses; no owner-drivers were captured among respondents.
– [2] From Provincial Transport Regulatory System records of vehicle types associated with active OLs.

Passenger transferring behavior is similar across the associations, with approximately 38 (31) percent of Assoc A (Assoc B) passengers transferring to another mode at the PTI (Behrens, Hawver, et al., 2017; Saddier et al., 2019). However, differences arise in which modes passengers transfer to, which may be due to the inherent characteristics of how passengers travel from the two associations, but is at least partly due to the decline in train reliability between data collections; Assoc A transfer data was collected in 2015 and data for Assoc B was collected in 2018, coinciding closely with the precipitous decline in service on Metrorail's Central Line. Assoc A passengers mostly transferred to the train (58 percent) while only two percent of Assoc B passengers did so. Assoc B passengers mainly transfer to GABS (32 percent) or MBT (29 percent) services while 12 percent transfer to MyCiTi. This transfer behavior further supports the need for complementarity between scheduled and unscheduled services as a large proportion of passengers from both associations transfer to scheduled modes at the Mitchells Plain PTI.

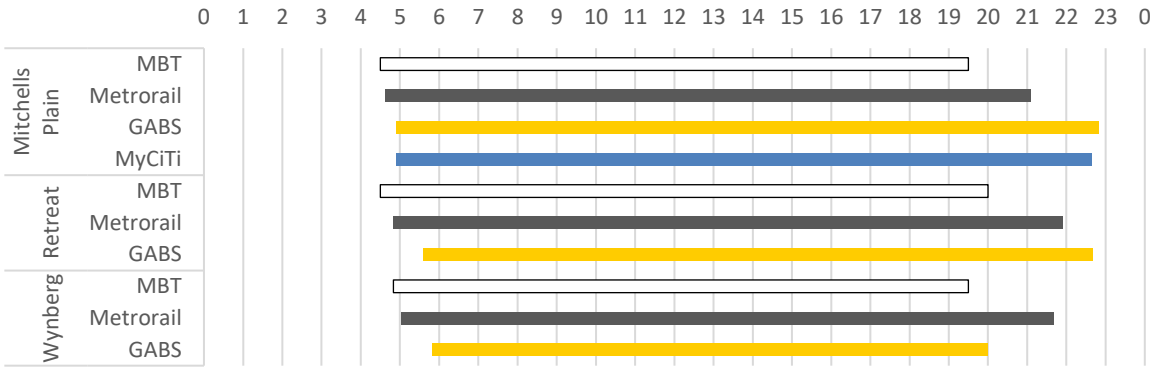
Previous research has assessed the level of complementarity in Mitchells Plain between MBT feeder/distributor service and scheduled PT trunk service with respect to MBT service span and frequency (Behrens, Hawver, et al., 2017). These are common quality of service factors globally for scheduled PT services (Transportation Research Board, 2013); for MBT services with no schedules, service frequency data can easily be collected and assessed for rank departures (Behrens, Hawver, et al., 2017; Saddier et al., 2017). Issues were found particularly related to service span, with MBT service ending too early to accommodate later trunk service arrivals, as well as some indication of long wait times for MBT departures during off peak times. While passenger satisfaction is reasonably high for these feeder routes in general (Behrens et al., 2018), the City seeks to provide 18-hour service across the PT network (TDA, 2014), which aligns with international standards for service quality (Transportation Research Board, 2013).

A passenger satisfaction survey of three feeder associations in the area found that passengers were generally satisfied with morning and evening service availability, though passengers were surveyed between the hours of 9 am and 1 pm, suggesting that these passengers are less likely to be concerned by the lack of evening service (Behrens et al., 2018). Latent demand is notoriously difficult to quantify. One operator clearly stated an expectation that passenger demand would grow over time if the service was provided as people became aware of it and could depend on it.

Security issues are a major concern at the Mitchells Plain PTI which was clearly communicated through a focus group used to design the SC survey—described in chapter 6 (*Drivers*)—and noted by a survey conducted for TDA finding that passengers feel most unsafe in the evening hours partly due to the real or perceived ineffectiveness of private security personnel (Yellowwood, 2018).

Figure 8 compares service hours of each mode at the Mitchells Plain PTI along with two other PTIs; these other cases are discussed later in this chapter. Service span mismatches, or lack of service complementarity, is an issue at all three locations. MBT services generally start earlier than scheduled services, likely to enable passengers to reach PTIs in time for the first scheduled departures to the CBD and other employment hubs; however, MBT services end earlier than scheduled services in the evening, sometimes many hours earlier. In discussions with operators, and because paratransit operates only when profitable, passenger demand appears to be lower during the evening hours. However, other factors such as security also play a role. Service span information was collected for MBTs through discussions with operators and from January 2019 schedules for scheduled modes.

Figure 8. PT service spans by mode by PTI. MBT data from operator discussions; others from schedules.



While the decline in rail service means that many passengers may be using other trip combinations to travel, the need for improving service span complementarity between modes at these PTIs remains an important issue as rail will likely remain a critical mode in Cape Town assuming rehabilitation. In addition, GABS services are present at all three PTIs and MyCiTi is present at Mitchells Plain and is being planned for Wynberg. In addition, latent demand may be present though simply too small to generate a profit for the MBT industry; service for these passengers remains important.

The most robust information is known about the lack of complementarity between Assoc A and scheduled modes at the Mitchells Plain PTI because of the established relationship that UCT researchers have with the association. This has allowed a series of research projects to be undertaken with the association's cooperation and has built a robust body of work around their operations. In addition, operators from Assoc B have participated in a capacity building program by a UCT researcher that allowed access to an additional association in Mitchells Plain (Schalekamp, 2017a). In addition, the two associations have been involved in a TOC pilot undertaken by TDA officials that tested a scheduled service with the existing operators.

Because robust information is known about the two Mitchells Plain associations and established relationships and trust enables a strong working relationship with the executives, this research has focused here. This ongoing relationship built over many years supported my ability to conduct this research and, as is discussed in chapter 7 (*Owners*), highlights the need for this trusting relationship to be successful working with the MBT industry. The industry is accurately characterized by mistrust of outsiders (chapter 2 *Literature Review*) and previous research that has benefitted them, or at least not harmed them, provides a key foundation for additional research. On the other hand, new relationships were forged with the three associations across Retreat and Wynberg and the newness of these relationship meant that I had less access and willingness to participate as compared to those in Mitchells Plain. However, this additional information was deemed important because of the potential

mindset change arising from the capacity-building program and TOC pilot that may mean that the two Mitchells Plain associations have a different outlook on potential interventions for service improvement than those who have not participated in such programs and pilots. Therefore, the associations in Retreat and Wynberg were engaged.

Figure 9. Images from the Mitchells Plain PTI showing MBT ranks. All photographs taken by the author.

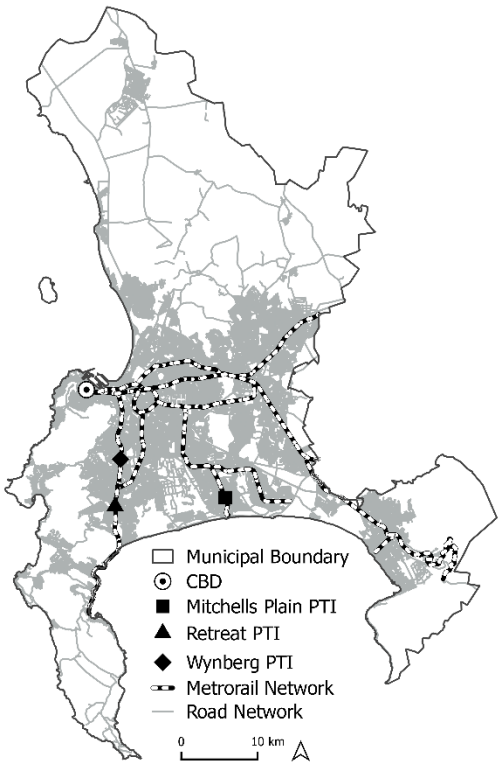
3.2 Secondary case descriptions

While the primary focus of the research was the Mitchells Plain case with the two feeder associations described above, additional data collection was undertaken at two other PTIs in Cape Town. Data was collected only with owners to enable some conclusions about the representativeness of the Mitchells Plain associations to feeder associations elsewhere in the city. While this will be helpful in broadening the perspective provided by this research, it should be noted that no association can be deemed representative as operating contexts, personalities, and many other factors impact how associations

operate and behave as entities. More details about how these areas and associations were selected is discussed in chapter 7 (*Owners*).

Data was collected from associations operating from the Retreat and Wynberg PTIs (Figure 10), both of which are located along the Southern Suburbs railway line. Association C (Assoc C) operates from Retreat while Association D (Assoc D) and Association E (Assoc E) operate from Wynberg[2]. The rail line first reached Wynberg in 1864 and was later extended further south to Muizenberg (and past Retreat) in 1883; the modern reincarnation of the rail system is an electrified commuter rail network (Wilkinson, 2000). Cape Town initially developed along this railway line and by the 1920s the previously independent municipalities had been incorporated into the Cape Town City Council (Wilkinson, 2000). After passage of the Group Areas Act, the Land Tenure Advisory Board zoned lower Wynberg for Coloureds (Bickford-Smith et al., 1999); Retreat was similarly designated a Coloured area (Lohnert et al., 1998) which led in the late 1950s to forced removals of Blacks from the Retreat area to Gugulethu and Nyanga and paved the way for government to build subsidized housing for Coloured individuals (Meier, 2000).

Figure 10. Location of Mitchells Plain, Retreat, and Wynberg PTIs relative to Cape Town CBD.



Source: Author using City's Open Data Portal, https://web1.capetown.gov.za/web1/opendataportal/Default.

[2] The following associations were willing to be identified: Assoc C as Retreat Taxi Association and Assoc D as Lotus River Ottery Taxi Association.

From the 2011 Census and author estimates, Assoc C serves an area with an estimated population of 52,755. The area is mainly Coloured (65 percent) and Black (28 percent) with Whites making up only three percent of the total (*South African Census Community Profiles*, 2011).

Assoc D operates in an area of population 43,726 of which almost 80 percent are Coloured and only eight percent Black and seven percent are White. The area in which Assoc E operates had a population of approximately 24,489 in 2011. Of this total, 67 percent were Coloured, 16 percent White, and 11 percent Black. Both areas are somewhat wealthier than Mitchells Plain (*South African Census Community Profiles*, 2011).

In addition to scheduled rail PT, these two PTIs are served by GABS scheduled bus services as well as unscheduled line-haul MBT services. No MyCiTi services have been implemented in these areas though Wynberg falls within Phase 2A and will be a major trunk route terminal; the opposite terminal will be in Mitchells Plain Town Centre and in Khayelitsha. Retreat does not fall into the Phase 2A area and will therefore not receive MyCiTi services in the medium term.

The Wynberg area is a considerable employment and activity hub, similar to the Mitchells Plain Town Centre, while Retreat PTI has less surrounding activity. Like Town Centre, both are among the top 10 busiest PTIs in Cape Town (Du Preez et al., 2019). The Southern Suburbs railway line has been in decline along with the rest of the Metrorail system, though may have fared better than the Central Line which serves Mitchells Plain. Cancellations appear to be less frequent and train on-time performance and reliability appear generally better on the Southern Suburbs line which suggests that feeder associations may be less impacted in these areas. However, no data is available to corroborate this assumption.

Characteristics of associations included in additional owner data collection are shown in Table 4; Assoc C operates from the west side of the Retreat PTI while Assoc D and Assoc E are based on the east side of the railway line in Wynberg. Assoc D and Assoc E operate routes similar to those of Assoc A and Assoc B in Mitchells Plain that both start and end at the PTI and mainly serve surrounding residential areas. Assoc C routes serve a wider range of destinations and distances including more line-haul routes such as Hanover Park, Fish Hoek, and Wynberg and feeder routes including Seawinds and Capricorn. Despite differences in routes, all fares are consistent.

Table 4. Characteristics of Associations C, D, and E.

Characteristic	Assoc C	Assoc D	Assoc E
PTI	Retreat	Wynberg	Wynberg
Member count	49	46[1]	19[1]
Drivers/owner-drivers	106	57[1]	35
Percent drivers (v. owner-drivers)	85%	unknown	70%
Routes as operated	8	7	1
One way route average distance (km)	8.0[3]	10.5[2]	5.3[2]
Flat fare in 2018	ZAR 10	ZAR 10	ZAR 10
Pay system	Target	unknown	Target
Percent CAM/Siyaya/Hiace vehicles	18%[1]	28%[1]	10%[1]

Notes:

– All data from unstructured data collection through conversations with operators unless otherwise noted. Blanks indicate no information available or provided by respondent.

– [1] From Provincial Transport Regulatory System records of vehicle types associated with active OLs.

– [2] From author's GPS tracking of routes as personally experienced.

– [3] From author's estimation via Google Maps of quickest route to destinations named by operator.

3.3 Summary

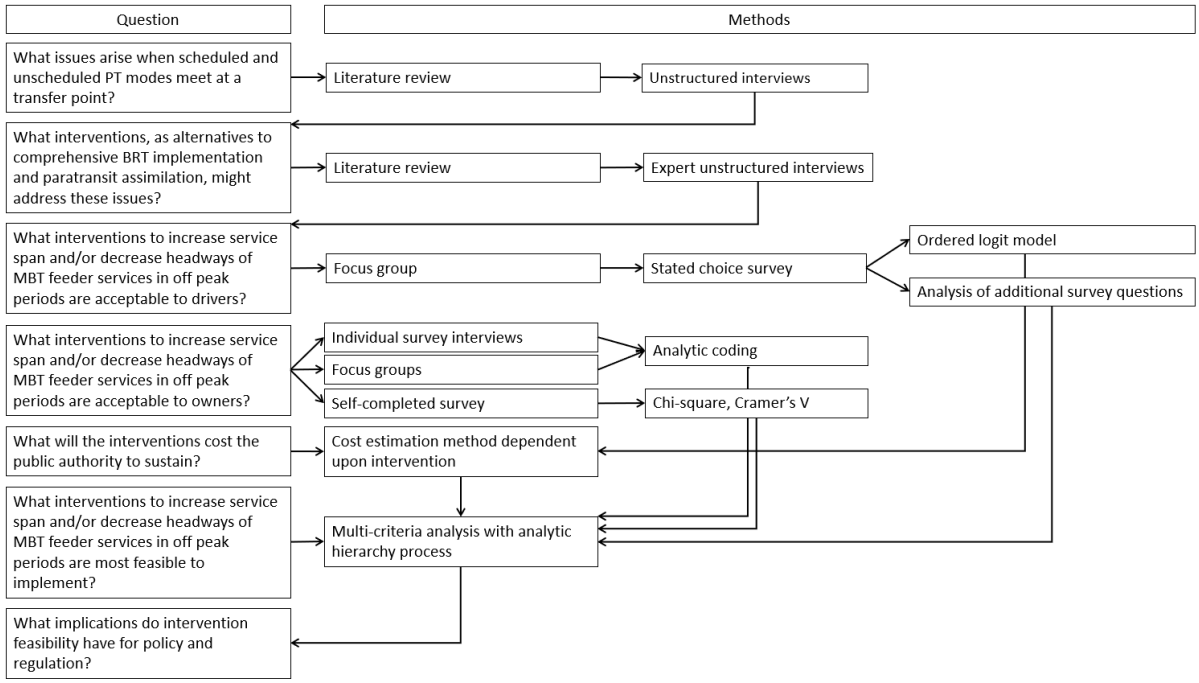
With complementarity issues known, questions remain regarding mechanisms by which such transfers might be improved. In many cities with only scheduled services, PT is either directly operated by a public authority or is contracted to private operating companies through tendering, allowing for relatively easy service level adjustments (White, 2017). In Cape Town, however, individual MBT owners and drivers are under no obligation to provide service during periods when ridership demand will not produce an attractive profit or if there is a high risk of robbery (Behrens, McCormick, et al., 2016; Cervero, 2000; Schalekamp & Behrens, 2013).

A variety of policy interventions might be considered to improve the complementarity of service spans, including, among others, the introduction of a range of incentives or off peak MBT feeder services operating under contract to the City. These interventions have varying implications for MBT business operations and driver remuneration, the latter of which is based on fare revenue rather than hours worked. The success of efforts to reform the city's PT network will, therefore, depend heavily upon the willingness of MBT drivers (as the key decision-makers with respect to the timing and frequency of service) and owners to provide complementary service under new "hybrid" conditions (McCormick et al., 2016). Mechanisms attempted elsewhere globally are discussed in chapter 5 (*Interventions*) and provide support for the interventions explored with operators in this research. Perspectives from operators on these interventions are described in chapters 6 (*Drivers*) and 7 (*Owners*) and synthesized in chapter 8 (*Implementation Feasibility*) to indicate to City officials which interventions might be most feasible to implement based on the industry perspective.

4 Methods

This chapter provides an overview of the methods used throughout the various components of this research and directly connects the methods used to the research objectives stated in chapter 1 (*Introduction*). An overview of the methods used to answer each research question is shown in Figure 11.

Figure 11. Methods used by research question.



Each section of this chapter presents methods in the order they were undertaken in the research and are presented in this thesis (Table 5). Full details of methods are found throughout the remainder of the chapters where relevant; this chapter simply gives a high-level overview of the research project. For example, the interventions explored with drivers and owners are discussed in chapter 5 (*Interventions*) and the process of designing these interventions is discussed in that chapter as well. As discussed in chapter 2 (*Literature Review*), MBT drivers make day-to-day operational decisions about service provision while owners control the vehicle. Hence, both stakeholders must be engaged to determine whether interventions to address service quality issues (evening span and headway, as discussed in chapter 3 *Research Context*) are feasible overall. Methods specific to each group are discussed in the relevant sections below with details in respective chapters.

Table 5. Research objectives mapped to relevant section below and following chapters.

Research objective	Section (overview)	Chapter (details)
What issues arise when scheduled and unscheduled PT modes meet at a transfer point?	*Understanding the situation*	3 (*Research Context*), 6 (*Drivers*)
What interventions, as alternatives to comprehensive BRT implementation and paratransit assimilation, might address these issues?	*Intervention design*	5 (*Interventions*)
What interventions to increase service span and/or decrease headways of MBT feeder services in off peak periods are acceptable to drivers?	*Driver data collection*	6 (*Drivers*)
What interventions to increase service span and/or decrease headways of MBT feeder services in off peak periods are acceptable to owners?	*Owner data collection*	7 (*Owners*)
What will the interventions cost the public authority to sustain?	*Costs, feasibility, and implications*	8 (*Implementation Feasibility*)
What interventions to increase service span and/or decrease headways of MBT feeder services in off peak periods are most feasible to implement?	*Costs, feasibility, and implications*	8 (*Implementation Feasibility*)
What implications do intervention feasibility have for policy and regulation?	*Costs, feasibility, and implications*	9 (*Discussion*)

4.1 Understanding the situation

The most important first step of this research was building trust and personal relationships first with leadership of the associations then with the other owners and drivers. Both owners and drivers and others at ranks, like rank marshals, are more willing to share information once you have an established relationship. Over time and many visits to the rank, information was more openly shared with me. These were unstructured discussions that sought to understand the passenger demand and travel patterns, history of the association and area, current operating challenges, and revenue and cost data. I also rode each of the routes operated by each of the Mitchells Plain associations to gain insight into passengers, the neighborhood, and the behavior of drivers on the road. This broad and unstructured fact-finding enabled relationship building piece by piece and also allowed me to gather more and unexpected information compared to a more structured method. Gathered information supported design of later more structured data collection instruments and made them much more effective and tailored, using appropriate terminology and calibrated values. Further method details regarding visits and information gathering can be found in chapter 6 (*Drivers*).

Beyond the primary goal of building trust, information gathering supported:

- An understanding of why evening services are not provided (a lack of hybrid complementarity) and the current operating context;
- Design of interventions to address this lack of complementarity;
- Design of a SC survey to assess driver acceptability of interventions; and
- Design of a mixed method data collection effort with owners.

While my visits assisted in understanding the current lack of complementarity between scheduled and unscheduled services, there is also research documenting this issue in the literature. Hawver (2016) analyzed vehicle departure records provided by Assoc A that record the plate number and time of each vehicle leaving the rank throughout the day. It was found that off peak headways can, at times, be long and that no MBT service is provided after approximately seven in the evening despite continuing train arrivals at the PTI (Behrens, Hawver, et al., 2017). This service span mismatch is the primary issue that interventions in this research seek to address. More detail about the lack of complementarity can be found in chapter 3 (*Research Context*).

It became clear through visits that drivers and owners have differing perspectives on the business and would likely also have differing perspectives on potential changes to the business to address complementarity issues. Because the issues—mismatched service spans and possibly long off peak headways—identified in the literature and confirmed through my visits and discussions are operational issues, it was important to first engage drivers regarding intervention acceptability as they are the operational decision-makers (as discussed in chapter 2 *Literature Review*). However, interventions first had to be designed.

4.2 Intervention design

Knowing the issues regarding service complementarity, I set about designing interventions to address them. I reviewed the literature to find examples and case studies where attempts have been made to address similar complementarity issues between scheduled and unscheduled PT services at a transfer point. These cases informed me of what has and has not worked elsewhere so that I could address past failings within the design of interventions for this research. For example, Jakarta paratransit operators were incentivized for improved service from government funds, but these incentives were passed through owners. The system was not sustainable because drivers did not trust owners to pass the appropriate incentives to them. More on this and other examples are discussed in *5.1 Precedents from the literature*. From understanding the situation (above), it was clear that a similar distrust was

present among drivers in Mitchells Plain; therefore, interventions were designed so that drivers received incentive payments directly from government.

While the literature was helpful, it is also limited. Many reforms go undocumented, but because of the global push for comprehensive BRT implementation, less attention has been paid to alternative methods for improving paratransit service quality, specifically regarding transfer complementarity. Critical thinking heavily supplemented literature to determine the suite of interventions and the design within each. In addition, consultation with experts proved invaluable. Academics, practitioners, and government officials knowledgeable in the MBT space provided feedback and interventions were amended accordingly.

After a refinement process, the final set of interventions number seven in total. They vary in approach and impact; some address only the service span mismatch by encouraging drivers to provide additional trips past 7 pm, while others do this and also attempt to maintain short headways to reduce wait time for passengers. Details on intervention design and the interventions themselves can be found in chapter 5 (*Interventions*).

4.3 Driver data collection

With interventions designed, drivers and owners needed to be engaged to determine which might be acceptable to them if government were to pursue such reforms. Drivers were engaged first because they determine operations and interventions are intended to change the operational characteristics of the service.

After exploration of methods, a SC survey was chosen because of its ability to aggregate repeated choice data to create a model that would allow prediction of driver behavior based on variable inputs. Having the model would allow determination of outcomes without having to return to drivers; simple changes to model inputs are all that is needed. Additionally, it provides estimates of willingness to pay (WTP), or in this case willingness to accept (WTA); by requesting additional trips from private, unsubsidized operators during times when trips are not profitable, some incentive must be given. Discrete choice modelling provides an indication of how much incentive would need to be paid for a particular requirement such as leaving the rank within 20 minutes of the previous departure, or for using a CFC system. These incentives are costs to government, a key policy concern; therefore costs of each intervention were estimated according to the method discussed in chapter 8 (*Implementation Feasibility*).

Standard practice for designing a SC survey includes extensive exploration of the problem and testing of the survey instrument. This effort began with my unstructured visits to the rank which allowed me to collect revenue and cost data, passenger count data, and to understand what factors drivers consider when deciding whether to be on the rank to provide a trip for passengers, or to stay home. More structured data collection used a focus group to corroborate and expand my understanding of driver decision-making to inform the selection of attributes and levels for the survey. The literature was consulted throughout the design process for more standard design choices, but also for those specific to a unique population that may have less formal schooling and speak multiple languages, though very limited literature exists on SC surveys conducted in the paratransit space or with paratransit operators as respondents. As such, this survey provides a contribution to the literature.

Once the survey instrument was designed, I pre-piloted it with master's and PhD students in my cohort at UCT. Some adjustments were made afterwards and prior to a pilot using an improved instrument with drivers from Assoc A. This pilot was critical to improving the survey as one attribute was removed because it was ignored by all of the respondents and the range of profit attribute levels were narrowed to force more trading. Administration of the survey used a paper-based instrument and provided a choice of language.

While the SC data was intended to determine acceptability, insignificant attributes forced use of an alternative method to determine acceptability via the additional questions included after the SC portion of the survey was complete. This resiliency in the instrument was critical. The acceptability method used is detailed in chapter 6 (*Drivers*).

4.4 Owner data collection

While the driver perspective on interventions is critical because they seek to address operational shortcomings of MBT service and drivers are the actors responsible for these decisions, no intervention will be successfully implemented without the support of the vehicle owner. Therefore, owners were engaged to collect both quantitative and qualitative data to assess acceptability of interventions. Combining this acceptability with that of drivers and costs then provides key information for City officials on which reforms will be most feasible to implement; the process for determining overall feasibility is described in the next section, *4.5 Costs, feasibility, and implications*.

Because owners are affiliated to an association and City officials typically engage owners at the association level, data collection with owners sought to replicate this situation by engaging them as a group. Focus group discussions were organized by association, but the method was adjusted to add structure. Each intervention was introduced and discussed in turn alongside collection of individual

data through a paper-based questionnaire. Group responses—to mimic the decision-making likely to occur within the association that is fraught with power dynamics and personalities—assessed what the association perspective might be on interventions. Details on facilitation are described in chapter 7 (*Owners*).

Discussion within focus groups was recorded, transcribed, and coded to draw conclusions about owner opinions and to add context to the quantitative responses received on questionnaires. Aggregated individual responses were compared to the group response, and associations were compared to each other. Importantly, Mitchells Plain associations were compared to a set of associations from outside this area to give some indication of whether Assoc A and Assoc B are unique. Chi-square and Cramer's V statistical tests were used to assess whether differences between groups were significant.

While it was intended that focus groups would be organized with associations outside of Mitchells Plain, the lack of established relationships with these associations proved problematic. After many attempts over 6 months, it was decided that individual interviews, rather than focus groups, would be more feasible among these additional associations. Previous work with MBT operators in Cape Town faced challenges of access as well, forcing a similar adjustment in expectations (Schalekamp, 2015). In Johannesburg, work with MBT drivers resulted in lower than desired response rates and mid-stream adjustments in the research approach as well (Randall, 2019). Details on the process of engagement can be found in chapter 7 (*Owners*).

4.5 Costs, feasibility, and implications

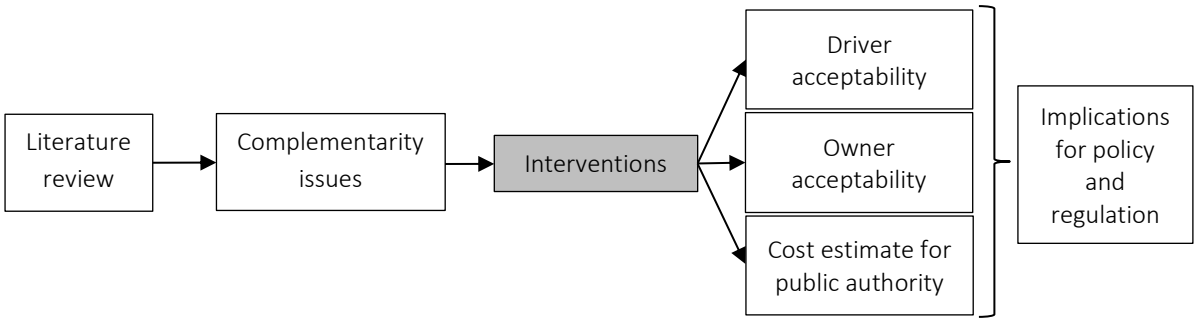
One of the major concerns arising from Phase 1 of MyCiTi implementation is the high operational costs associated with scheduled trunk and feeder BRT service provision (chapter 2 *Literature Review*). There has been recognition that these costs are unsustainable, and therefore evaluation of alternatives to scheduled feeder services must consider operational costs. The first part of chapter 8 (*Implementation Feasibility*) details the method used to estimate costs for each of the seven interventions to provide an order of magnitude indication of annual cost. The method varied by intervention because each has unique characteristics, though three are based in the value needed to obtain a reasonable chance of drivers agreeing to provide service based on the choice modelling results presented in chapter 6 (*Drivers*). The Off peak contract uses existing MyCiTi feeder operations cost data from comparable routes, E-hailing considers the cost to develop and maintain the app that would enable the service, and Rank security considers the cost of a South African Police Services (SAPS) salary for the evening period. Finally, the Higher evening fare intervention estimates the cost

to passengers of that higher fare. As much as possible these costs are comparable; more details and resulting estimates are in chapter 8 (*Implementation Feasibility*).

The second part of chapter 8 (*Implementation Feasibility*) synthesizes the driver and owner perspectives to determine which interventions were most acceptable overall. These two components, in addition to cost and four others—transition difficulty, complementarity issues addressed (service span only or service span and headways), use of a CFC system, and whether TDA must administer payments—were combined in a multi-criteria analysis to suggest which interventions are most feasible to implement. The justification for the inclusion of these criteria, weighting (through the Analytic hierarchy process (AHP)), and scoring can be found in chapter 8 (*Implementation Feasibility*). Results of the analysis are discussed and compared to results under a scenario where drivers are given a tax exemption. Driver and owner perspectives are also compared on a few parallel indicators. The final section summarizes the findings, setting the stage for chapter 9 (*Discussion*) where policy implications are discussed.

This portion of the thesis highlights the key contribution of this research, namely an attempt to understand a portion of the MBT industry's perspective on potential reform approaches in a holistic way. Considering both major stakeholders is critical to success and few reform efforts engage in any meaningful way with drivers. In addition, this research was not constrained to BRT-related reform, instead including a much broader set of reforms.

5 Interventions



The purpose of this research is to identify the most feasible mechanisms, or interventions, to achieve improved paratransit service complementarity with scheduled services, primarily to address service span mismatch and secondarily to keep headways short. This chapter introduces these interventions in detail but begins by discussing examples from the literature where mechanisms have been implemented in other cities globally. These examples inform the design of the interventions explored with operators in this research though in many cases the literature is limited, and additional information was sought from experts in the field.

Later chapters refer to this chapter when describing driver (chapter 6 *Drivers*) and owner perspectives (chapter 7 *Owners*), and cost estimates (chapter 8 *Implementation Feasibility*) to determine which of these interventions seem most achievable for the public authority (chapter 8 *Implementation Feasibility*).

5.1 Precedents from the literature

As discussed in chapter 2 (*Literature Review*), trunk and feeder networks may hold promise for integrating paratransit into a reformed, hybrid network. Chapter 3 (*Research Context*) highlighted the issues found in Mitchells Plain, Retreat, and Wynberg when scheduled and unscheduled services meet; the solution to these problems must therefore improve the transfer between these modes for passengers especially because trunk and feeder PT systems inherently require large numbers of passengers to transfer between services (Thompson & Matoff, 2003). There is considerable literature on transfer best practices, and while it mostly pertains to transfers between scheduled modes, many are still applicable and should be goals for transfers in the case of transfers between trunk service provided by scheduled modes and feeder services provided by MBTs. In the United States, paratransit services are for non-traditional PT riders such as those in wheelchairs; while a very different type of service, it is still on-demand and often feeds scheduled modes when possible to mainstream passengers. Koffman (2004) suggests these transfers should be free. There is wide consensus that

schedules should be integrated to reduce waiting time (Hine & Scott, 2000; Lau, 1997; Morlok et al., 1997; Potter & Skinner, 2000; Thompson & Matoff, 2003), and in some cases US paratransit is guaranteed to meet arriving trunk buses (Koffman, 2004). Gautrain midibus service, while scheduled, is operated by MBT operators and meets arriving trains (Semake & Nortje, 2018). Evening and weekend services are important to serve passengers outside of traditional commute times (Hine & Scott, 2000; Koffman, 2004; Lau, 1997), supported by the Basic Conditions of Employment Act of South Africa which requires transport to be available to employees working at night (Department of Labour, 2016) and by the Operating License Strategy of the City which sets a goal of 18 hours of PT service per day (TDA, 2014). Research conducted in Puerto Rico which, while a territory of the US, has paratransit as defined in this research, lists suggestions for service improvement including guaranteed hours of service and possibly providing scheduled service during off peak periods to improve reliability (Lau, 1997).

Beyond physical and temporal integration, fare integration is also important in trunk and feeder networks. Phase 1 of MyCiTi uses integrated fare payment across all routes, meaning that passengers no longer have to pay for journey legs separately and fares do not fluctuate due to operator whims; however this also means that passengers may no longer be able to negotiate fares (Venter, Jennings, Hidalgo, & Pineda, 2018). Regardless, fare integration and fare policy are key tools to promote equity in BRT systems, with flat fares allowing higher income passengers to subsidize lower income passengers who generally live further from opportunities (Venter et al., 2018). While none of the interventions described later introduce free transfers, some involve the implementation of CFC which can enable future benefits. Likewise, few interventions introduce scheduled services; however, one (Off peak contract) would do so and some others seek to keep headways short to serve passengers while keeping changes minimal. All interventions seek to ensure evening services, addressing the primary issue of service span mismatch.

Cities have used various mechanisms for ensuring transfers are complementary across scheduled and unscheduled modes within a trunk and feeder network. Such networks are common, both in cities that have undertaken some type of reform (such as Quito and Sao Paulo) as well as others that have not (such as outside the MyCiTi implementation area in Cape Town, where MBTs provide feeder services to certain PTIs). Where cities have not implemented feeders as part of PT reforms, paratransit operators often adapt routes to feed trunk services without exogenous prompting. While paratransit adaptation goes a long way to improving service, it is unlikely to match scheduled services at an ideal level. Examples of mechanisms to ensure this generally fall into three categories: reward

schemes, area licensing, and concessions (Behrens, Salazar Ferro, et al., 2016; Salazar Ferro & Behrens, 2015).

Reward schemes can also be considered incremental reforms, as discussed in chapter 2 (*Literature Review*) as an alternative reform approach. These reforms seek to capitalize on paratransit benefits and address issues through changes that do not require formalization or major structural changes to the operating environment.

In Quito, paratransit services were allowed to run parallel to BRT services as well as provide feeder service in peripheral and residential areas (Salazar Ferro, 2015; Salazar Ferro & Behrens, 2013). Operators were incentivized to bring passengers to BRT stations via a per passenger payment by government but continued to provide unscheduled service as independent operators licensed for specific routes (Salazar Ferro, 2015; Salazar Ferro et al., 2015). Problems developed with vehicle standards and in-route competition and eventually a concession agreement was made with operators (Salazar Ferro & Behrens, 2013). While a similar issue may arise with interventions explored in this research, the trust built between government and operators through small-scale changes may enable larger changes to address over-competition and vehicle standards later at a lower cost to government than restructuring and contracting with the industry.

Drivers in Jakarta were required to offer reduced fares for transferring passengers and then received a reimbursement plus bonus, but the system did not last because drivers did not trust owners to pass along the reimbursement from government (Behrens, Salazar Ferro, et al., 2016). Interventions in this research explore the possibility of government paying drivers directly to avoid this trust deficit. More recent attempts in Jakarta have been more dramatic, requiring feeder service operators to form either cooperatives or companies to bid for gross cost contracts with Transjakarta, the BRT operator (G. Ramadhan, personal communication, 16 July, 2018). The contracts specify quality standards such as headways and driver non-smoking.

While not focused on feeder services per se, the eThekwini municipality (Durban) is in the planning stages for the Public Transport Accelerated Service Improvement Program (or Moja Cruise) that would pay drivers and owners monthly for improved vehicle maintenance, driving behavior, and customer service and monitor service via vehicle tracking devices (Schalekamp & Klopp, 2018). Formalization is not an immediate goal of Moja Cruise, which sets it apart from many reform approaches. This approach is similar to that of many interventions in this research that seek to directly incentivize drivers for improved service; incentives to owners is an interesting addition that may be warranted if owners are resistant to changes.

Area licensing, which can also be considered an incremental reform to some degree, worked well in Recife, Brazil, where demand for scheduled trunk service increased by over 31 percent and trip times were reduced after paratransit operators were reorganized into neighborhood feeders (Behrens, Salazar Ferro, et al., 2016). Operators were not required to formalize, though were required to sign service agreements that specified maximum headways and fares (Ferreira et al., 2005). Vehicles were still allowed to stop anywhere. This approach is similar to the Headway bonus intervention though it does not include fare control. While ridership benefits may have arisen from the reorganization of paratransit into feeders in Recife and in Mitchells Plain the feeders are already operational, this is an indication that improved headways are possible without formalization.

Santiago provides an interesting example of paratransit integration via concessions within a larger effort to implement BRT, setting it apart from other reforms discussed here (Salazar Ferro & Behrens, 2015). Most paratransit operators had previously formalized into operating companies, but those who had not were given a short time to do so in order to participate in the tendering for nine newly-created feeder areas (Salazar Ferro et al., 2015). Services were operated as feeders in association with Transantiago, though fares remained unregulated (Behrens, Salazar Ferro, et al., 2016). Operating zones did not overlap, but did have an 800 meter buffer area that promoted some competition to maintain service quality (Salazar Ferro & Behrens, 2013). An unintended consequence was inflexibility, and the system was later revised to reintroduce some of the benefits of paratransit, such as high coverage, by reducing the rigidity of the concession boundaries. This example provides key lessons for overall network design and cautions against introducing too much rigidity; many interventions explored in this research avoid this rigidity by continuing to allow paratransit flexibility in stopping locations and routing, most explicitly in the E-hailing intervention. In the case of Santiago, some benefits accrued from previous efforts towards formalization which are unlikely to translate to Cape Town, though in some situations associations themselves are well-organized and capable of undertaking reforms.

In addition to collecting and keeping all fare revenue, paratransit operators are paid by the municipal government in Porto Alegre as part of what is termed a sponsored concession (Behrens, Salazar Ferro, et al., 2016). As was the case in Santiago, operators had formalized to some degree prior to this reform.

Delhi had a considerable paratransit system, called blue line buses, operated by individual owners with operating licenses for specific routes (Gadepalli et al., 2018). These operators were reformed under the Scheme for Corporatization of Private Stage Carriage Services into cooperatives to operate a bundle of routes within areas called clusters (Gadepalli et al., 2018). Each cluster had a bundle of

low and high demand routes to ensure viable operations over the bundle. The goal was to de-link operator income from passengers carried to address aggressive driving, but to maintain some competition within clusters by allowing government-run buses to operate alongside cluster buses on an integrated schedule. Operators bid for ten year gross cost contracts that included rewards and penalties determined through tracking devices and smartcard systems (DIMTS, 2017). However, results have been mixed; integrated scheduling has not come to fruition and cluster buses have issues with crashes and speeding (Roy & Bhattacharya, 2018).

The concept of de-linking passengers carried and income earned addresses the key incentive imposed in paratransit operations to compete for passengers as described in chapter 2 (*Literature Review*). Only two interventions explicitly do this—Off peak contract and to a lesser degree Operating deficit payment—though many others seek to reduce the pressure to compete for passengers by paying incentives. Monitoring via tracking devices is a common theme among many of the precedents and is used in the interventions in this research as well; some also use CFC as the Delhi buses do. Integrated scheduling did not prove possible in Delhi, possibly suggesting that this is an ambitious goal in the immediate term. Only one intervention here attempts this.

Two examples are linked with rail developments. In Valparaiso, Chile, a rail line was rehabilitated and the rail operator was interested in maximizing ridership through feeder services. Paratransit operators were paid for schedule adherence and for delivering passengers to rail stations under a concession agreement that specified routes and schedules (Salazar Ferro & Behrens, 2015). The rail operator collected fares and paid paratransit operators, who had formalized. Paratransit operators who did not want to participate were allowed to continue operating but would not benefit from the demand induced by the new rail service.

Similarly, the Gautrain began operations between Pretoria and Johannesburg and the operating company recognized a need for feeder services to new train stations. Negotiations with the MBT industry resulted in the formation of a company from representatives of two MBT associations that were contracted to provide scheduled feeder services aligned with Gautrain arrivals and departures. The MBT industry continues to provide competing services along routes, with the Gautrain midibus service competing as a premium service with air-conditioned buses and a higher fare. An agreement was made that fares for the new service would not be lower than existing MBT fares to prevent unfair competition. Negotiations were therefore much less fraught than efforts in Cape Town that resulted in full replacement of MBT services and the associated risk that BRT service provision would not be as profitable as the status quo. Services are provided under a service level agreement with specified

schedule, routes, and penalties for non-performance. Drivers are reportedly happy under this arrangement as they work shorter hours and make predictable incomes (Semake & Nortje, 2018).

It appears that reward schemes may not be very promising considering that both examples eventually failed and regulators opted for more formalized arrangements. However, neither precedent had robust monitoring programs in place to streamline incentive payments and ensure service was indeed provided as expected. Attempting improved versions of these seems warranted. Even if reward schemes cannot be a long term solution, they likely build trust between operators and government making subsequent reforms of a more dramatic nature less contentious.

It also appears that the success of concessions hinged on operators having been formalized prior to the introduction of the concession (i.e. Santiago and Porto Alegre) similar to the process described in the stepped, flexible approach to reform in chapter 2 (*Literature Review*). The shift from individual, independent operators to formal cooperatives or companies is arguably the more problematic reform to undertake; once this is complete, concessions are relatively simple to implement. This suggests that efforts to complete all these steps at one time are overly ambitious and that completing each step separately may lead to greater success. Certainly the MyCiTi rollout experience supports this conclusion.

While these precedents provide some insight into potential approaches for integrating paratransit as feeders into a multimodal network, past attempts at wholesale adoption of approaches from South America have proven problematic, suggesting it is critical to use them only as guides. Therefore, the purpose of this research is to investigate methods for integrating MBTs as feeders to scheduled trunk PT that will improve quality of service for passengers but be amenable to the MBT owners and drivers that will provide the service. Aligned with recommendations to take an incremental approach (Schalekamp & Klopp, 2018) it is clear that "arrangements without drastic transformation of the paratransit sector are possible" (Salazar Ferro & Behrens, 2013). Therefore, many of the interventions considered use elements from these precedents, rather than corporatization, to encourage service provision.

5.2 Interventions

As much as possible, interventions were informed by the literature. However, paratransit integration has only recently been given the attention required to adequately inform PT reform efforts and the literature remains limited; this limits information available to design and investigate interventions for this research but highlights the need for it. Some have suggested that authorities might "…subsidize paratransit supply; but no such case has been documented" (Salazar Ferro, 2015). Other work warns

that any change to payment systems "impacts on the whole business model and relations between operators, labour and passengers (Schalekamp et al., 2017) and another suggests that smaller interventions may be less attractive to the forces of corruption (Timse, 2018). The City has stated that any interventions into the MBT industry must acknowledge that the industry is entrepreneurial, is a critical empowerment mechanism, and is relatively well-organized and formalized (TDA, 2017). Clearly this is a complex area that must be carefully considered. Despite lengthy consideration given here to interventions, many details remain to be considered if these interventions are to be implemented, as noted in chapter 9 (*Discussion*).

Many of these interventions may never have been attempted, though this is difficult to say unequivocally as much work is not documented. Reliance on shared knowledge from experts in the field was an important way to ensure that this set of interventions covered most, if not all, realistic options. To that end a number of South African paratransit experts were consulted once an initial set of interventions was developed. In addition to Roger Behrens and Herrie Schalekamp at the UCT Centre for Transport Studies, these experts included:

- Christo Venter, University of Pretoria
- Elizabeth Hastings, Pegasys Strategy and Development
- Johan Joubert, University of Pretoria
- Nicolette van Niekerk, Pegasys Strategy and Development
- Paul Browning, Transforum

Seven interventions were developed that might be successful in encouraging drivers to provide evening service where none is currently provided, addressing a key service quality issue as described in chapter 3 (*Research Context*). Four would directly increase driver earnings from public funds to compensate for lower passenger demand; three of these allow for the continued operation of independent MBT businesses in the association form while one requires formation of corporations to contract for service provision with the city. An additional intervention would also directly increase driver earnings, but through higher fares rather than public funds. The final intervention targeting driver earnings is a technology solution that does not directly increase driver earnings through incentives or payments, but rather provides a platform that will hopefully lead to increased driver earnings. And finally, one intervention would impact driver earnings indirectly by reducing the chance of theft by providing increased security at the rank. The seven interventions are listed in Table 6.

For interventions to successfully incentivize drivers, owners must keep the daily target the same, or in the case of commission systems, allow drivers to keep all of the additional money earned in the

evening rather than splitting it with the owner. If owners adjust their requirements, the inducement of the incentives at a given monetary value are diluted and are unlikely to encourage drivers to provide service.

Costs of each intervention are estimated in section *8.1 Intervention costs*.

Table 6. Description of interventions to encourage evening service provision.

Intervention	Description	Service quality defects addressed
Rank security	SAPS officer stationed at the rank in the evening. Extra security could make drivers feel safe enough to operate later.	Service span
Transfer bonus	Small amount paid per passenger that transfers from trunk to MBT feeder in off peak, counted by intermodal cashless fare collection (CFC) technology.	Service span
Headway bonus	Payment per vehicle trip that departs in less than specified headway monitored via vehicle tracking devices.	Service span and headway
Operating deficit payment	Payment to cover operating deficit plus guarantee a small profit via MBT-only CFC technology.	Service span, possibly small headway effect
Off peak contract	Newly formed MBT operating company is contracted to provide off peak service at specified service quality levels monitored by CFC and vehicle tracking devices.	Service span and headway
E-hailing	Drivers use e-hailing app to serve passenger demand during off peak periods via shared rides.	Service span only, but may reduce wait time
Higher evening fare	Association/ drivers charge higher fares in the evening to allow drivers to operate profitably with lower demand. No cost to city.	Service span

5.2.1 Rank Security

This intervention does not seek to increase driver income, but instead increases security by positioning a SAPS officer at the rank during the evening period. This intervention would simply increase driver perceptions of security which, through the initial focus group held to assist in survey design, seemed to be a promising way to obtain evening service with no involvement in MBT operations. There was almost unanimous agreement among focus group participants that a SAPS officer would significantly improve the situation at the rank. The current City-contracted security guards that are present at the rank overnight were seen as ineffective; participants stated that they typically lock themselves in the toilets at the rank to protect themselves, leaving other individuals and property vulnerable.

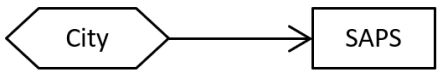
This intervention also serves the interest of passengers. In a passenger satisfaction survey of users of these MBT feeder services, Behrens et al. (2018) found that rank security was an element of service that passengers considered both important and dissatisfactory. A survey undertaken by a firm for the

City corroborates this lack of security from the passenger perspective, suggesting a SAPS officer would be beneficial for all stakeholders (Yellowwood, 2018).

Owners, as members of the association, would need to advertise the fact that a SAPS officer would be present in the evening to ensure drivers were aware of the change. The association could also provide office space for the officer as an inducement, though this might also encourage the officer to be inside rather than out on the rank where his/her presence is needed. Considering it is in their interest, drivers that choose to stay later because of this increased security can monitor the SAPS officer's attendance and relay concerns to the City via the association leadership.

Monetary flows for this intervention remain unchanged from the status quo, which is outlined in Figure 17. The City would simply need to pay the salary of a SAPS officer for three hours per day.

Figure 12. Rank security monetary flow diagram. Solid line indicates electronic payment.



5.2.2 Transfer bonus

This intervention seeks to increase driver earnings by providing a bonus payment for each passenger that transfers from a trunk PT service to a MBT in the evening period. Such an approach was used in Quito, Ecuador, where individual operators maintained their independence and no formalization or scheduling was required (Behrens, Salazar Ferro, et al., 2016; Salazar Ferro et al., 2015). However, the arrangement used cash payments given at the time of passenger delivery and this approach seems untenable in Mitchells Plain in the evening when security concerns are clearly present, but also because cash payments may be problematic for the City if the arrangement were to be audited. At a larger PTI like Mitchells Plain, it would be impossible to track passengers from alighting to boarding location to determine if they did in fact make a transfer.

Instead, a CFC system would be used to count passengers qualifying for a Transfer bonus to ensure a clear paper trail for the City to reference when making payments. This system is likely to increase security by making vans less attractive targets for robbery at the end of the day when cash fares have amassed. The MYFIN 2018 Operational Plan and Strategy for Public Transport 2018-2033 clearly states the city's intention to make CFC systems compatible across modes (TDA, 2018a), which suggests a tap on-tap off smart card system. However, many technologies exist and no specific technology is specified for this intervention. In the case of this transfer bonus, the CFC system does not necessarily depend on tap-off capability; many systems globally, including the Washington

Metropolitan Area Transportation Authority in Washington, D.C., provide free transfers across buses with only tap on capabilities by specifying a time limit between first and second taps (WMATA, n.d.). Transantiago uses a tap on-only smartcard system allowing free transfers for subsequent trips up to three legs and within two hours from first to last tap (Muñoz et al., 2014).

The use of a CFC system does not, however, necessitate a shift to salaried drivers. Owners will receive the fare payments under this arrangement (see Figure 13), but may still pay drivers based on the 70/30 percent commission system as Assoc B currently does, or on the same target basis as is the case for Assoc A. Therefore, while it is likely that better visibility of pay by owners will lead to some changes in pay, it may not result in salaried drivers which many have proposed would fundamentally change incentives for drivers to aggressively compete for passengers on the road.

One certain result of shifting to CFC is the tax burden; currently all money flows are undocumented in cash, which allows both owners and drivers to avoid tax obligations by underreporting or not reporting at all. With CFC, monetary flows are documented for at least owners; if owners pay drivers electronically, drivers will also be liable. The South African Revenue Service (SARS) clearly states that tax must be paid on wages, salaries, and other income (SARS, 2018c), with provisional tax to be paid on non-salary income which would likely apply to the MBT industry (SARS, 2017a). Both fare revenue and bonus payments are taxable. More details are discussed in *5.3 Intervention implications*.

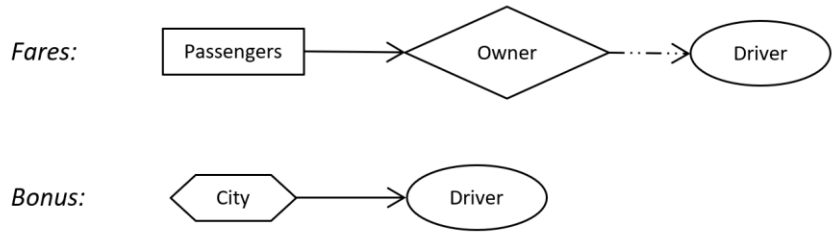
This intervention requires a tracking device to be installed on the vehicle for monitoring purposes. Without it, drivers may be tempted to create phantom passengers by registering taps without passengers and thereby earning bonus payments from the City while avoiding any service provision (cost). Accomplices could tap on to the MBT and drivers could pay those accomplices in cash for the value of the fare taken off the card and simply not provide a trip at all. By matching the timestamp on taps and tracker data, the City can prevent cheating.

While part of a broader reform, the Delhi Integrated Multimodal Transit System Ltd uses automatic vehicle location devices to monitor buses operated by the paratransit industry as part of a system of area-based concession contracts. Data collected includes speeding, route deviation, missed trips, bunching, and others (DIMTS, n.d.; Sahai et al., 2009).

CFC shifts the flow of money through the system rather dramatically (Figure 13). Owners rather than drivers receive fare revenue, with owners then responsible for paying drivers. As discussed above, this does not necessarily mean that drivers will be salaried. A CFC system does mean fares are paid electronically to owners, who can then choose whether to pay drivers electronically or in cash. The City will always pay driver bonuses electronically to comply with the Municipal Finance Management

Act that states payments must go directly to whom they are due and via electronic means or by non-transferable check (Municipal Finance Management Act, 2004).

Figure 13. Transfer bonus monetary flow diagram. Solid line indicates electronic payment while dash-dot line indicates payment either in cash or electronically.

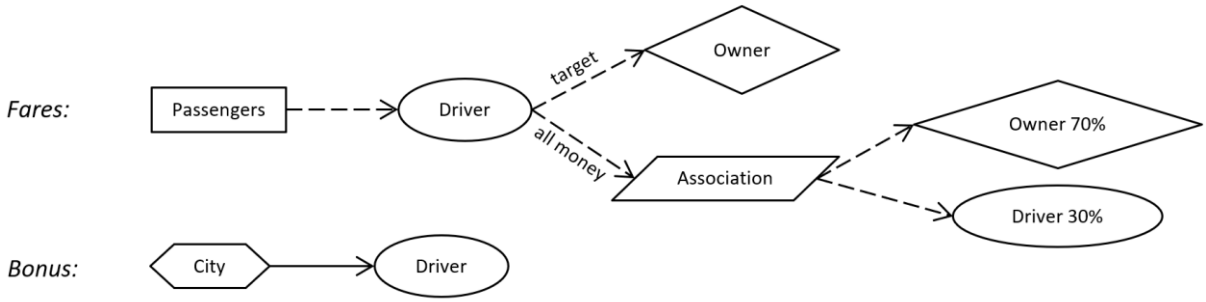


5.2.3 Headway bonus

With this intervention, drivers are given a bonus payment for each trip provided within a specified time limit. The City could specify 30 minute headways and determine, via tracking devices on vehicles, when subsequent departures from the rank maintain this quality of service and therefore qualify for a bonus payment. Again, a tracking device also ensures driver honesty in making trips.

Drivers would need to pay tax on at least the bonus money paid by the public authority as these would be paid electronically or by check and are therefore documented (Municipal Finance Management Act, 2004). Fare revenue remains cash-based and therefore undocumented. Per the MBT passenger satisfaction survey, cash fare payment was a point of relative satisfaction and importance among daytime users in Mitchells Plain, suggesting this intervention may be popular among passengers. The Moja Cruise program intends to incentivize drivers to provide fixed headways in a similar way (Schalekamp & Klopp, 2018) and a concession system in Bogota used a similar concept of driver monitoring linked to a system of penalties and rewards related primarily to frequency and reliability (Hernández & Mehndiratta, 2015).

Figure 14. Headway bonus monetary flow diagram. The branch after Driver in the Fares diagram shows alternate payment systems (target v. commission) by association. Dashed lines represent cash payment while solid lines represent electronic payment.



5.2.4 Operating deficit payment

This intervention involves the City paying driver operating costs plus a guaranteed profit for each trip provided. For this intervention specifically, revenue and costs both need to be known by the City to determine the deficit payment to make. The CFC system will assess fare revenue while vehicle tracking devices are necessary to determine fuel costs as well as ensure driver honesty. With fuel costs increasing semi-regularly, costs of operation go up as well, suggesting a need for ongoing monitoring (AA, n.d.). Though instituted in a concession-like context, the Dakar bus renewal scheme incorporated a deficit payment to compensate operators in the case of government denying a fare increase request (Kumar & Diou, 2010).

Like in the Transfer bonus intervention, CFC will increase security by removing large amounts of cash from vehicles and drivers will be obligated to report and pay tax on both fare revenue and incentives (SARS, 2017a, 2018a, 2018c). The Municipal Finance Management Act (2004) again applies, requiring direct payments to drivers via electronic means (or, less likely, by check).

One potential issue with use of CFC is that drivers may still take cash fares, circumventing CFC in attempts to increase payment from the City by reducing visible revenue through fares. In the survey, one driver explicitly stated an intention to collect cash fares on the side even if a CFC system was implemented, suggesting implementation will need to be carefully considered.

Additionally, an expert highlighted the potential for such an intervention to encourage oversupply. With drivers guaranteed a small profit for each trip regardless of passenger count, drivers may oversupply services and cost the City significant sums. To counteract this behavior, a cap could be placed on the amount of bonus payments a driver can earn in a particular day.

An Operating deficit payment may also address the headway issue to some degree by ensuring drivers a small profit regardless of passenger count, allowing them to make equivalent revenue with fewer

passengers and therefore shorter waiting times. This intervention could also be adjusted to encourage ridership by lowering fares in the evening (the opposite of the Higher evening fare intervention); the corollary is increased cost to the City from lower fare revenue.

Monetary flows are identical to the those under the Transfer bonus intervention and are shown in Figure 13.

5.2.5 Off peak contract

Under the contract reform, feeder services are provided by a fully formalized MBT sector likely with gross cost, per km contracts as used in Phase 1 of MyCiTi (Schalekamp & Klopp, 2018) and in other cities such as Bogota (Salazar Ferro & Behrens, 2013). Vehicles would be owned and scheduled by the company to provide scheduled service that adheres to the service levels specified in the contract.

Cape Town intends to develop an integrated CFC system for the PT network, suggesting that any service would require CFC (TDA, 2018a). Current MyCiTi services use an EMV-compliant smartcard payment system that is administered by a third-party contract separate from the City and the operating companies. Bogota followed the same standard practice of separating fare collection duties from operations (Hernández & Mehndiratta, 2015).

The operating company would be obligated to pay tax on earnings. Owners receiving salaries for positions held in the company would pay income tax and as shareholders would pay Dividends Tax on any dividends (SARS, 2018d). More detail on taxation is discussed in *5.3 Intervention implications*.

The National Minimum Wage Act of 2018 requires that all workers are paid at least ZAR 20 per hour and for at least four hours in any day worked (National Minimum Wage Act, 2018). However, it is likely that bus drivers under this contracting arrangement will be paid in accordance with the South African Road Passenger Bargaining Council (SARPBAC) collective agreement that stipulates minimum hourly pay of ZAR 47.83 for drivers in BRT systems through 31 March 2018 (SARPBAC, 2017), especially considering that issues have arisen in Nelson Mandela Bay as a result of agreements being made for wages and benefits that are not aligned with this SARPBAC agreement. At such rates, drivers will certainly earn more than the threshold for income tax obligations.

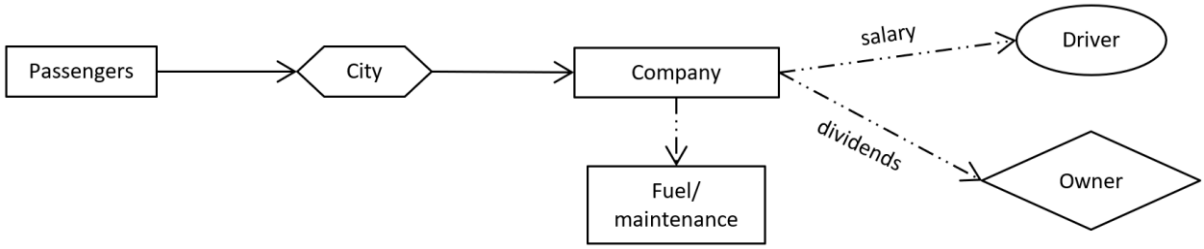
Contract adherence would be monitored via vehicle tracking devices. The Bombela Operating Company subcontracted the MBT industry to provide midibus feeder services to some Gautrain stations and uses tracking devices to monitor service levels and assess rewards and penalties for measures such as on-time performance (Semake & Nortje, 2018). Bogota also used tracking devices

as part of an incentive and penalty system mainly related to frequency and regularity (Hernández & Mehndiratta, 2015).

The company structure brings benefits for City officials in that it avoids disruption stemming from MBT association elections; negotiations can stall or be forced to restart if new leaders shift direction (Semake & Nortje, 2018). One individual in the MBT industry has stated that shareholding in a company provides more security for an earner's family compared to running an independent MBT business; under the current environment, if an owner dies his/her spouse may not be familiar enough with the business to continue earning from it. Conversely, shares transfer easily and provide a steady stream of income with no skill requirements. However, these benefits must be weighed against the costs associated with corporatization, transformation, and compensation as noted in chapter 9 (*Discussion*).

The flow of money under this intervention is shown in Figure 15.

Figure 15. Off peak contract monetary flow diagram. Solid lines indicate electronic payment while dash-dot lines indicate payment either electronically or in cash.



5.2.6 E-hailing

This intervention does not seek to directly increase driver earnings, but rather to spend City funds on developing a smartphone e-hailing app to be used by drivers. The expectation is that passenger demand would either increase or become more visible to drivers by providing a more efficient way for drivers and passengers to find each other and would increase their earnings enough to encourage them to drive later, a claim made by the creators of MBT app Aftarobot as well as by the City in the Integrated Public Transport Network Business Plan (Aftarobot, 2018; TDA, 2017). Similar to the operations of UberPool, vehicles would be routed based on passenger boarding and alighting requests through the app. To ensure security especially in the evening, trips will likely be door-to-door rather than corner-to-corner like the service provided by Via, among others (Via, 2018). Some passengers in Mitchells Plain have started using e-hailing services for shopping by coordinating with neighbors to make the trip cost effective; at current fares, a short e-hailing trip split among four passengers is less expensive than MBT fares (C. Govender, personal conversation, 28 May 2019).

Fares will likely be based on time and distance rather than a flat fare as is the case currently for Mitchells Plain feeders. Such a fare structure is almost universal across individual and shared ride on-demand e-hailed services and this granular level of fare pricing is simple through the app. App-based services have in-app payment capabilities (Glon, 2018; *How Does Uber Work?*, n.d.), yet in South Africa and other countries fares can be paid in cash (Uber, n.d.). Odd fares will be more difficult with cash payments but provide more options for passengers. Other services like Twende ("we go" in Kiswahili) in Tanzania accept payment through mobile money accounts, in this case from Tigopesa (Tigo, 2018). A similar service but for motorcycle taxis called SafeBoda accepts payments in cash, bank card, or mobile money (*Home | SafeBoda*, 2018).

Regardless of actual payment form (cash or cashless), all revenue is documented through the app and therefore both drivers and owners are obligated to report and pay tax on this revenue. Like the other interventions involving CFC, drivers do not necessarily shift to a salary under this intervention. Tax obligations are the same as well; drivers and owners who make above the threshold pay income tax (SARS, 2018a).

E-hailing apps allow passengers to see the location of the driver assigned to them (Glon, 2018), and because the City is funding the development of the app, use of the app will likely be conditional upon data collection on operations for planning and enforcement purposes. Therefore, the app acts as a tracking device similarly to the other interventions that have tracking devices in a different form.

This intervention has the potential to maintain short headways in addition to encouraging service in general. Current operations incentivize drivers to leave only when vehicles are full to maximize profit (Behrens, McCormick, et al., 2016); using an e-hailing app, drivers are able to field requests from passengers beyond the rank which may encourage them to depart with less than a full van because they know how many passengers will be picked up along the way.

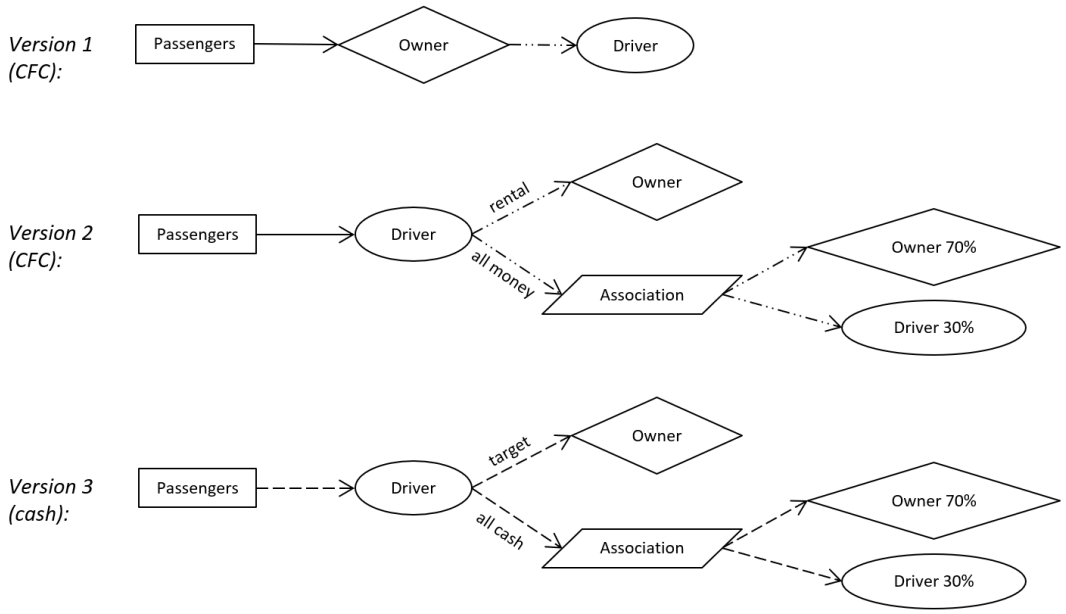
Operators may be interested in using this app for services throughout the day because it provides the owners greater insight into the business and may increase earnings for drivers, as is the hope for the evening period. Certainly the City would find this agreeable, because the funds spent to develop the app would be producing benefits over a greater span of time. Enforcement may become a challenge if operators shift between on-demand routing based on the app and route-based operation as is the current situation.

Money could flow in different ways under this intervention, depending on whether owners or drivers receive the money initially and whether fares are paid in cash or through the app (Figure 16). Across all versions, money is documented and therefore taxable.

- In Version 1, passengers pay fares through the app to the owner who then pays the driver either electronically or in cash.
- Version 2 has fare revenue going to drivers initially, who then pay owners either a target or commission. Because fees to send electronic funds transfers and to withdrawal money at the till are similar, drivers are equally likely to pay using either form.
- In Version 3, however, fares are paid in cash to drivers who again pay either a target or commission, but likely via cash because of relatively high fees for cash deposits. By paying expenses with the cash in hand, drivers will deposit less and therefore pay less in fees.

Passengers will pay using different forms, so in almost all cases drivers and owners will experience Version 3 combined with either Version 1 or 2.

Figure 16. E-hailing monetary flow diagram. Solid lines indicate electronic payment, dashed lines indicate cash payment, and dash-dot lines indicate payments either electronically or in cash.



5.2.7 Higher evening fare

One method for increasing driver profit to encourage service provision is for the association to charge a higher evening fare. With fewer passengers in the period of interest from 7 pm to 10 pm, charging a higher fare may allow drivers to make a similar profit on evening trips as they do on daytime trips when passenger demand is higher. One expert expressed concern that this contradicts standard practice in fare policy, where peak period riders are charged higher fares in an effort to spread the peak demand and reduce the number of vehicles required to provide needed peak capacity. However, Salazar Ferro (2015) has suggested this as a potential mechanism and at least one MBT association in Cape Town already employs this technique as in the case of Main Road Route Taxi Association where

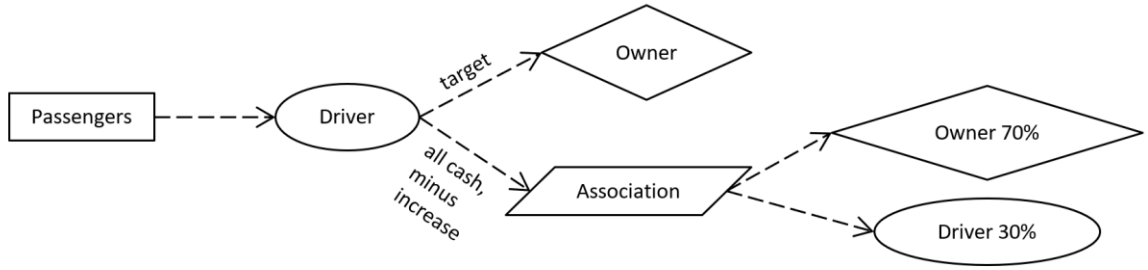
posted fares indicate an increase for evening travel. In addition, GABS provides late night service from the CBD to Mitchells Plain for roughly twice the price of a normal fare, dropping passengers in front of their door (Lynn Davids, personal communication, October 4, 2018). In this case, because the evening period of interest starts well beyond the end of the afternoon peak, a higher fare is not expected to have a major negative impact on peak spreading.

Under this intervention, no other changes to the current operating environment are made. And because increased driver profit is sourced from passengers, no public/City funding or effort is required to potentially achieve improved service. The issue of fare affordability arises; low income Capetonians are significantly cost burdened, paying more than 10 percent of household income on PT costs. In an area of low to moderate income, this is a critical issue (TDA, 2018b). In addition, BRT passengers (in Gauteng at least) desire lower fares (Hayes & Venter, 2017, p.; Venter, 2016); to attract passengers to a future BRT trunk and feeder system, charging higher fares for services may be counterproductive. It may not be desirable from the City perspective to allow for this intervention, though monitoring would be very difficult once an association chose to raise fares. On the other hand, it may be that passengers are willing to pay a higher fare to have the service provided because it currently does not exist at all.

This intervention is unlikely to maintain short headways, though in some cases, as noted by another expert, drivers may depart the rank with one or two fewer passengers than normal (15, or a full van) because a higher fare allows them to make the same gross revenue with fewer passengers. However, drivers are also likely to maximize their revenue by charging higher fares and still filling the van.

The flow chart below outlines the flow of money through the system (Figure 17). The branch after Driver in the Fares diagram shows alternate payment systems (target v. commission) by association. Note that for this and any diagram that shows the association as intermediary between owners and drivers on the commission system, the association can be removed; the diagrams were outlined this way because Assoc B conducts money management in this way. Other associations may forego this role and owner and drivers simply split the money between them.

Figure 17. Higher evening fare monetary flow diagram. Dashed lines indicate cash payments.



5.3 Intervention implications

Table 7 summarizes the implications associated with each intervention described above. This is to provide a wider picture of the interventions in terms of advantages and disadvantages as well as collaboration and coordination requirements. Taxation implications for drivers and owners are discussed later in this section, while the method used to estimate costs of each intervention is discussed in chapter 8 (*Implementation Feasibility*).

Table 7. Summary of implications associated with each intervention.

Name	Advantages	Disadvantages	Tech-nology	TDA responsibility	External collaboration
Rank security	Relatively simple to implement	– One officer may be risky/ineffective. Multiple officers costly. – Does not address issues on route	None	– Monitoring – Addressing coordination issues	– SAPS – Contract manager for security guards currently at rank
Transfer bonus	No cheating - must use CFC to count pax to get bonus (no cash fares on side)	– Huge coordination effort for CFC – Could further encourage fill and go because pax at rank are more valuable with bonus	– Vehicle tracker – Inter-modal CFC	– Monitoring – Payment administration	– Metrorail, GABS, MyCiTi, line-haul MBT – Tech provider x2 – Banks
Headway bonus	Directly improves headways	Costs to govt could be high with oversupply. Capping will complicate implementation.	Vehicle tracker	– Monitoring – Payment administration	Tech provider
Operating deficit payment	By keeping profit small, does not encourage oversupply	– Costs to govt could be high with few passengers – Potential for cheating by taking cash fares to double dip fares and bonus income	– Vehicle tracker – MBT-only CFC	– Monitoring – Payment administration	– Tech provider x2 – Banks

Off peak contract	– Costs are known – Service quality control – Reliable service	– Contracting and monitoring costs – Corporatization effort – Minimum wage, etc. compliance	– Vehicle tracker – CFC	– Monitoring – Payment administration – Contract management	Tech provider x2
E-hailing	– No wasted time or fuel – May improve security by reducing rank wait time/ allowing door-to-door service	– App development effort/cost – May not result in increased demand – App training needed – Requires shift to area licensing – Passengers must have smartphones	App (same as tracker and CFC)	– Software contract management – Customer service?	App developer
Higher evening fare	No government effort or expenditure	Increases cost to users	None	None	None

Higher evening fare requires the least effort by the city, while Off peak contract requires the most effort, both in terms of corporatization and transition of the industry as well as contract negotiation and ongoing management. E-hailing also requires a relatively high level of effort from the City because of the need to contract for development and support of the app used to enable the service. Perhaps more consequential is the requirement for the operating license regulation structure to fundamentally change; e-hailing inherently requires on-demand routing, making the current system of route-based regulation a hindrance. A shift to area-based operating license permissions would be necessary.

Rank security, after Higher evening fare, requires a low level of City effort. An agreement with SAPS, the city, and the associations would be required, though cost of the officer could be partially defrayed by an adjustment of the contract for the private security staff currently paid for by the city.

Transfer bonus, Headway bonus, and Operating deficit payment interventions would require greater levels of effort, though Transfer bonus the most of these three because of the need for coordination between all PT providers and regulators to implement integrated CFC technology. This requires city, provincial, and national government (as regulators of various modes of transport) to work together. With all three interventions, monitoring of vehicle tracker data and administration of incentive payments will be needed, while Transfer bonus and Operating deficit payment requires additional coordination with banks and technology providers for CFC capabilities.

Shifting from a focus on implications for government, Table 8 summarizes owner and driver taxation implications for each intervention. All discussion of taxation assumes that drivers and owners have no income external to the MBT industry. Interventions can be clearly grouped into four categories. In

category one, both owners and drivers can avoid paying income tax because fares are paid in cash and therefore no record of income exists. No incentives are paid under the interventions in this category. Income tax relies on self-reporting and both parties are likely to at least underreport if not avoid reporting entirely.

Table 8. Tax implications for owners and drivers under the status quo and each intervention.

Category	Interventions	Money visibility	Driver tax implications	Owner tax implications
1	– Status quo – Higher evening fare – Rank security	None	Can avoid tax	Can avoid tax
2	– Headway bonus	Only incentives	Provisional taxpayer if above threshold; possibly below it	Can avoid tax
3	– Operating deficit payment – Transfer bonus – E-hailing	All fares and incentives (E-hailing no incentives)	Provisional taxpayer if above threshold; possibly below it	Provisional taxpayer; likely above threshold for indiv. income tax OR Turnover Tax
4	– Off peak contract	All fares, per-km payments, etc.	– Income tax payable on salary if above threshold; PAYE withheld monthly	– Income tax? – Dividends Tax (20%)

In category two, an incentive is paid to drivers for maintaining short headways. Because the City pays this amount, there is a paper trail which forces drivers to report at least this income. However, owners can continue to avoid income tax because fares continue to be paid in cash and therefore the target or commission income owners receive will also be in cash. Drivers qualify as provisional taxpayers because they are not earning salaries per se, but they do earn money from participating in the MBT business; income from both registered and non-registered businesses are subject to provisional tax (SARS, 2017a). If income exceeds the threshold of ZAR 78,150 per year, income tax must be paid according to the rates in Table 9 (SARS, 2018a).

Table 9. Individual income tax brackets and rates 2018/2019 tax year (1 March 2018 to 28 February 2019) (SARS, 2018a).

Taxable income (ZAR)	Tax rate
78,150 – 195,850	18%
195,851 – 305,850	35,253 + 26% of income above 195,850
305,851 – 423,300	63,853 + 31% of income above 305,850
423,301 – 555,600	100,263 + 36% of income above 423,300
555,601 – 708,310	147,891 + 39% of income above 555,600
708,311 – 1,500,000	207,448 + 41% of income above 708,310
1,500,000 and above	532,041 + 45% of income above 1,500,000

Owners are subject to income tax in category three because fare revenue and incentives are documented through a CFC system, or in the case of E-hailing, through the app. Assuming MBT owners are operating as sole proprietors, business income is treated as individual income (SARS, 2014). Therefore, they are subject to pay tax on earnings exceeding ZAR 78,150 per year per the rates in Table 9. However, if total revenue does not exceed ZAR 1 million, owners can opt to pay Turnover Tax instead of individual income tax (SARS, 2017b) according to the rates shown in Table 10. The situation for the driver remains the same as in category two.

Table 10. Turnover Tax rates (SARS, 2018b).

Revenue (ZAR)	**Tax rate**
0 – 335,000	0%
335,001 – 500,000	1% of income above 335,000
500,001 – 750,000	1,650 + 2% of income above 335,000
750,001 and above	6,650 + 3% of income above 750,000

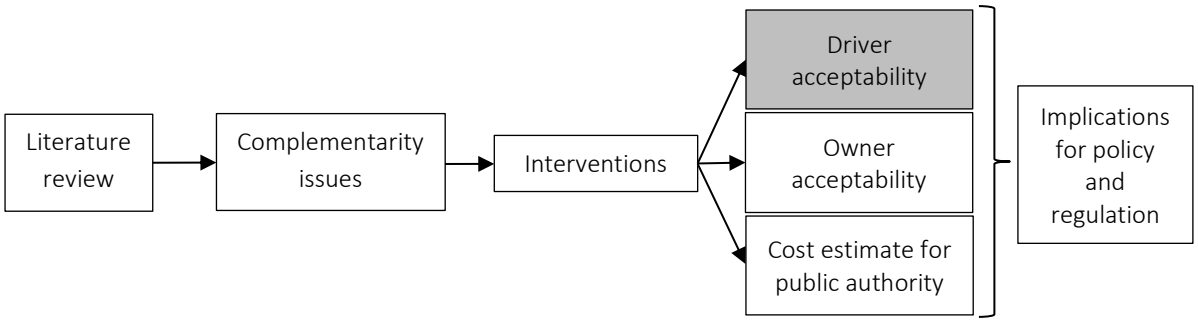
Category four applies only to Off peak contract, which differs from the other categories due to corporatization of operators. The situation for drivers remains roughly similar, with the same threshold and income tax rates as all other categories (Table 9); however, a shift to salaried employment means that Pay As You Earn (PAYE) applies, where taxes are withheld from each paycheck (SARS, 2017b). Owner income can come from two sources; the first is through a salary for a position held within the newly formed operating company and the second is through dividends from company earnings as a shareholder. If earning a salary, they are, for all intents and purposes, identical to drivers. Individual dividends are taxed at 20 percent assuming company turnover exceeds one million Rand per year (SARS, n.d., 2018d). The company is responsible for withholding this 20 percent on all dividend payments and paying SARS on behalf of shareholders, though shareholders ultimately remain liable (SARS, 2018d).

Because it will not be a sole proprietorship, the company is ineligible for Turnover Tax; therefore, earnings are taxed at 28 percent (SARS, 2017b). However, there are graduated rates available to companies that qualify as Small Business Corporations whose revenue does not exceed ZAR 20 million (SARS, 2017b). Initial earnings are taxed at rates ranging from 7 to 21 percent while the remainder is taxed at 28 percent (SARS, 2017b). The company is required to pay into the Unemployment Insurance Fund at 2 percent of the total remuneration paid to employees capped at ZAR 178,464 annually and to pay a Skills Development Levy at one percent of payroll if remuneration exceeds ZAR 500,000. Transport of fare-paying passengers is VAT exempt (SARS, 2017b).

5.4 Summary

This chapter reviewed the literature on paratransit integration mechanisms to inform the design of interventions explored in this research to address known service complementarity issues in Mitchells Plain. Seven interventions were detailed and monetary flows were presented visually to provide a complete understanding of the changes implied by each. Most are intended to increase driver earnings to ensure previously unviable trips due to lower passenger demand become viable and are therefore provided by drivers who depend on profitability for operations. Incentives paid by the City government are the source of increased earning in many, though one would source this money from charging higher fares. One intervention does not increase driver earning and instead provides increased security at the rank as an alternative incentive. One intervention, Off peak contract, is an equivalent to a contracted MyCiTi feeder per the approach in Phase 1 and will allow conclusions about the future approach to reform. The final section of this chapter considered implications of the interventions for coordination with external partners, TDA responsibility, and for driver and owner taxation. The stage has now been set to describe the method used to collect driver perspectives on these interventions in the next chapter 6 (*Drivers*) and the results obtained.

6 Drivers



This chapter describes the methods used to understand the perspective of the first of two key stakeholders in the MBT industry, i.e. drivers, on possible interventions that may improve services with the key goal to extend MBT services to match trunk PT service hours. Because drivers make operational decisions, a method that allowed assessment of incentive amounts was combined with questions about the conditions of the various interventions being considered. Following this, choice modelling analysis results are presented, followed by results from the non-choice section of the survey. The end of the chapter (*6.4 Summary*) discusses which interventions are most acceptable to drivers across Assoc A and Assoc B in Mitchells Plain. The methods for determining which interventions are most feasible overall as well as the cost of each intervention is described later in chapter 8 (*Implementation Feasibility*).

6.1 Driver survey method

6.1.1 Choice modelling background

Rather intuitively, choice modelling analyzes how individuals make choices by quantifying the impact of various factors on the choice being made (Hensher et al., 2015). The fundamental data are the choices individuals make either in reality or in a series of hypothetical decisions. The approach has been widely used across many disciplines to forecast adoption of agricultural seed products (Breustedt et al., 2008), understand patient preferences for primary healthcare consultations (Cheraghi-Sohi et al., 2008), and determine demand for a planned transport investment (McFadden, 1974).

Data for modelling choices originate either from revealed preference or stated preference sources. Revealed preferences can be observed from choices individuals make in real-life situations by comparing the choice made to the alternatives available to that individual. In contrast, stated

preferences must be elicited directly from willing respondents in the form of a survey that presents a hypothetical choice.

Each type of data has advantages and disadvantages. The main strength of revealed preference data is that choices have actually been made in reality, clearly indicating what the individual prefers. However, data for revealed preferences is limited to those situations that exist (Kroes & Sheldon, 1988). Often researchers are interested in assessing preferences before implementation, as is the case here.

Revealed preference data also has the potential to mask factors that contribute to an individual's choice if too little variation exists among choices. Train (2003) uses the example of electricity suppliers in the United States, where consumers are able to choose among a few companies to provide electricity to the home. Using revealed preference data in this situation could easily lead to an incorrect conclusion that consumers are not price-sensitive only because the cost of electricity across the various suppliers varies so little. Minimal price variation is actually likely due to the high price sensitivity of consumers that, through market competition, keeps prices constrained to a small range. A similar issue can arise when factors contributing to a choice are strongly correlated, such as travel time and travel cost. Determining the model parameters for such factors is difficult using revealed preference data (Kroes & Sheldon, 1988).

Stated preference methods address the issues of too little variation and of correlation by providing the researcher more control in presenting a hypothetical situation. Through this control, additional variables can be assessed than would otherwise be possible through reliance on existing choice data from revealed preferences. A key practical benefit of stated preference surveys is the ability for a single respondent to provide multiple data points by responding to a series of varied choice situations. Fewer overall respondents are needed to obtain a statistically significant model, saving research funding (Kroes & Sheldon, 1988). This advantage was particularly beneficial for this study because of the small number of potential respondents.

Within the category of stated preference, several formats can be used. SC surveys, where respondents are asked to select a single preferred alternative from a set of mutually exclusive alternatives, is commonly used. However, other formats include rating and ranking, best-worst, and frequency data. For an overview of these methods, see Hess & Rose (2009). Figure 18 shows a simplified example of a common application of SC methods in the transport field where respondents are asked to select a preferred mode of travel from a set of alternatives. Alternatives for car and train are listed in the last two columns, with attributes listed in the first column (travel time and travel cost)

and their varying levels listed across the rows for each alternative. The image as a whole is referred to as a choice set (or card or task) and is typically one in a series that is presented to a single respondent. The process is then repeated for other respondents. Rather than assess mode choice preferences by users, this study employs the SC format to elucidate service provider preferences, by determining MBT driver willingness to accept operational changes.

Figure 18: Example choice card for commute mode choice with labels corresponding to numbered terms (Bliemer & Rose, 2011).

Choice task 1 (of 9)

	car	train
Travel time	10 min.	15 min.
Travel cost	1.00 euro	0.50 euro
Your choice:	☐	☐

While there are other behavioral models used, such as random regret minimization (Chorus et al., 2014), discrete choice methods often assume respondents display utility-maximizing behavior. Thurstone (1927) is credited with first developing the concept of assessing differences in paired comparisons of psychological stimuli, while Marschak (1960) applied the concept to utility.

Train (2003) describes random utility models clearly and concisely in his text; the description here follows closely. The respondent, labeled *n*, is asked to choose an alternative, *j*, from the full set of alternatives, *J*, that provides them the greatest amount of utility. Utility for an alternative is denoted U_{nj} for $j = 1, \ldots, J$. A respondent will choose alternative *i* only if:

$$\mathrm{U_{ni}} > \mathrm{U_{nj}} \; \forall \; \mathrm{j} \neq \mathrm{i}. \qquad \text{Equation 1}$$

Equation 1 simply states that the utility provided by alternative *i* for respondent *n* is greater than that provided by the other alternatives in the choice set. Because the researcher has designed the survey to include particular attributes, the influence of these factors on utility can be assessed. The attributes included in the alternatives are denoted $x_{nj} \; \forall \; j$ and are included in a function to assess their influence on the choice made by the respondent. This function is:

$$V_{nj} = V(x_{nj}, s_n) \; \forall \; j \qquad \text{Equation 2}$$

Where s_n indicates characteristics of the respondent that can be collected through the survey. Such characteristics can provide some insight into how particular groups of people may be more or less likely to select certain alternatives. These two components come together to determine the representative utility. Note the change in notation from *U* to *V* for utility; this is an important

distinction. Unfortunately, the researcher is unable to observe all factors that influence an individual's decision. For practical reasons, only a finite number of attributes can be included in the experiment to ensure respondents can consider all the information presented to make a choice. An endless list of attributes will inevitably lead to respondents ignoring certain attributes, called attribute nonattendance (Hensher et al., 2015), or making choices at random. Either situation reduces the robustness of the resulting model. When designing the survey, a researcher uses literature review, focus group discussions, and consultation with experts to identify the attributes that individuals consider when making the choice of interest in the experiment. It is often impossible to identify every relevant attribute for every individual; the goal, therefore, is to identify the attributes that make the greatest impact on choice-making for the greatest number of individuals within the population. This results in an unobserved portion of utility referred to as $\mathcal{E}_{nj}$, that together with representative utility makes up total utility as in Equation 3 below. Because $\mathcal{E}_{nj}$ is unknown, it is considered random.

$$U_{nj} = V_{nj} + \mathrm{\varepsilon_{nj}} \qquad \text{Equation 3}$$

Representative utility is equivalent to a vector of attribute levels and associated parameter values β. Attribute levels that make up the alternatives presented to respondents on each choice card are independent variables, x_{nj}. These values are known. Associated with these are parameter values, β, to be estimated. Equation 4 shows that parameter values serve as weights for each attribute in the experiment, with estimation of the model using x_{nj} and respondents' choices to determine the value of each parameter.

$$U_{nj} = V_{nj} + \varepsilon_{nj} = \beta' x_{nj} + \varepsilon_{nj} \qquad \text{Equation 4}$$

Referring back to the hypothetical example in Figure 18 where a respondent is asked to choose a preferred travel mode considering travel time and travel cost, the full utility function for each alternative can be written as:

$$V_{n,car} = \beta' x_{n,car} = \alpha T_{n,car} + \beta C_{n,car} \qquad \text{Equation 5}$$

$$V_{n,train} = \beta' x_{n,train} = \alpha T_{n,train} + \beta C_{n,train}$$

Where *T* denotes the value for travel time and *C* denotes the value for travel cost as shown in each alternative. The number of parameter values is equivalent to the number of attributes in the experiment, represented here as α for travel time and β for travel cost. Representative utility for each alternative is calculated separately to determine which provides the greatest value to the respondent on a relative scale. If applied uniformly to all utility values for all alternatives, a multiplier or other

arithmetic adjustment to the values will not affect the outcome of the experiment as relative utility will remain the same.

Because ε_{nj} is unobservable and therefore not all information is known, the choice model is not deterministic but rather probabilistic. Choice models can only predict the probability of an individual making a particular choice and not what choice they will in fact make. This probability is determined by estimating the model using the choice data produced by respondents in conjunction with the attribute levels presented in the choice cards. The process of estimation is discussed below. Calculation of probability depends on the model selected; for the multinomial logit model used in this study, the probability of an individual *n* choosing alternative *i* is:

$$P_{ni} = Prob(V_{ni} + \varepsilon_{ni} > V_{nj} + \varepsilon_{nj}) \forall j \neq i \qquad \text{Equation 6}$$

$$= Prob(\varepsilon_{nj} < \varepsilon_{ni} + V_{ni} - V_{nj}) \forall j \neq i$$

The multinomial logit choice probability is then derived and can be written as Equation 7, which states that the probability of choosing an alternative, *i*, is found by exponentiating the representative utility for alternative *i* and dividing by the summation of exponentiated representative utility for all other alternatives. For the full derivation of Equation 7, see McFadden (1974) and Train (2003).

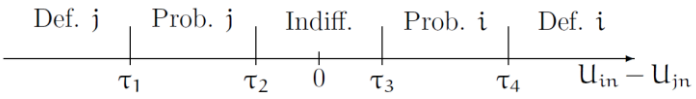
$$P_{ni} = \frac{e^{V_{ni}}}{\sum_j e^{V_{nj}}} \qquad \text{Equation 7}$$

Luce (1959) originally derived the multinomial logit formula and shortly after, as mentioned above, Marschak (1960) demonstrated that the model was consistent with utility maximizing behavior. McFadden (1974b) later demonstrated that unobserved utility must be distributed Type 1 extreme value in a logit model. The assumption that ε_{nj} is independently identically distributed extreme value means that unobserved utility is not correlated across alternatives and has the same variance for each alternative. The logit form that results from these assumptions is mathematically convenient, making it easy to use and interpret and therefore commonly used. If the model is specified sufficiently well—by ensuring the representative utility includes the vast majority of factors influencing the choice—unobserved utility should adhere to the required condition of independence and identical distribution because it represents only white noise.

A variation on the multinomial logit, the ordered logit, can be used in situations where responses are solicited using a rating scale such as *Very likely*, *Somewhat likely*, and *Not at all likely*. Rather than selecting one preferred alternative, a respondent indicates, for example, how likely they are to do something based on the attributes presented. Whereas the multinomial logit model assumes

unobserved utility is independent across alternatives, the ordered logit inherently assumes that ordered alternatives are more similar to adjacent alternatives than others. Therefore, in the likelihood example, *Not at all likely* is more similar to *Somewhat likely* than it is to *Very likely*. The fundamental characteristic of an ordered logit is a process of censoring latent utility, represented graphically by Figure 19.

Figure 19: Visual representation of ordered logit response categories censoring linear, latent utility with thresholds, τ (BIerlaire, 2009).



In a multinomial logit, there is a particular level of utility that a respondent derives from an alternative as a result of the attribute levels. This is not the case for a response to an ordered logit survey question; instead, it is assumed that latent utility exists on a continuous scale for each respondent and the response categories offered force the respondent to select the category closest to the level of latent utility. Therefore, the response category consists of a particular range of utility values separated by threshold values determined through model estimation (described below). This process is represented by Equation 8, where U_i^* represents the latent continuous utility separated by thresholds k into numbered categories U_i (Daly & Hess, 2014).

$$
\begin{aligned}
U_i &= 0 \text{ if } k_{-1} < U_i^* < k_0 \\
&= 1 \text{ if } k_0 < U_i^* < k_1, \\
&= 2 \text{ if } k_1 < U_i^* < k_2. \\
&\dots \\
&= J \text{ if } k_{J-1} < U_i^* < k_J
\end{aligned}
\qquad \text{Equation 8}
$$

Assuming $\mathcal{E}_{nj}$ is distributed logistic, the probability of responding *Very poor* to a question providing the five response categories *Very good*, *Good*, *Neutral*, *Poor*, and *Very poor* is expressed as (Train, 2003):

$$
\begin{aligned}
Prob(Very\ poor) &= Prob(U < k_4) \\
&= Prob(\beta' x + \varepsilon < k_4) \\
&= Prob(\varepsilon < k_4 - \beta' x) \\
&= \frac{e^{k_4 - \beta' x}}{1 + e^{k_4 - \beta' x}}
\end{aligned}
\qquad \text{Equation 9}
$$

And the probability of responding *Poor* to the same question is shown in Equation 10. The remaining three categories are calculated in a parallel manner.

$$
\begin{aligned}
Prob(Poor) &= Prob(k_4 < U < k_3) \\
&= Prob(k_4 < \beta' x + \varepsilon < k_3) \\
&= Prob(k_4 - \beta' x < \varepsilon < k_3 - \beta' x) \\
&= Prob(\varepsilon < k_3 - \beta' x) - Prob(\varepsilon < k_4 - \beta' x) \\
&= \frac{e^{k_3 - \beta' x}}{1 + e^{k_3 - \beta' x}} - \frac{e^{k_4 - \beta' x}}{1 + e^{k_4 - \beta' x}}
\end{aligned}
$$

Equation 10

Regardless of whether an ordered or binary logit is estimated, the use of SP data, with repeated choices by a single individual, introduces correlation across these choices (Abdel-Aty et al., 1997; Daly et al., 2013). Modeling must take repeated choices into account to avoid biased estimates (Abdel-Aty et al., 1997). In the past, repeated choices were assumed to only affect standard errors of parameter estimates; therefore, bootstrapping and jackknifing methods were used to correct standard errors (Bliemer & Rose, 2010; Hess & Rose, 2006). However, Ortúzar, Roncagliolo & Velarde (2000) tested both methods and found standard errors varied inconsistently and Hess & Rose (2006) indicate that both standard errors and the parameter estimates themselves are affected by the issue of correlation across repeated observations; as a result, these techniques are inadequate.

A multinomial logit is equivalent to assuming that a single individual responded to all choice tasks in the survey, which for SP data is a poor assumption (Bliemer & Rose, 2010). In contrast, a panel mixed logit aligns with the structure of SP data by allowing for variation between individual respondents but not across choices by a particular individual (Bliemer & Rose, 2010; Revelt & Train, 1998; Train, 2003). By using a mixed logit specification, the repeated nature of SP data is accounted for explicitly and parameter estimates are improved (Daly et al., 2013).

Within mixed logits, there are two specifications; one is the random coefficients mixed logit which is the most popular way of accounting for repeated choices (Hess & Rose, 2006; Train, 2003). The second is the error components mixed logit which accounts for repeated choices but independently of a specification, like the random coefficients version, that accounts for random taste heterogeneity (Hess & Rose, 2006; Train, 2003). As is discussed later in Results, this research is not interested in identifying random taste heterogeneity; Daly, Hess & Eckert (2013) suggest in this case to use the error component specification of the mixed logit to appropriately account for repeated choices without the additional parameters required for a random coefficients specification. Error component specifications are also particularly appropriate for assessing substitutions between alternatives that include a status quo option (as this research does) because the status quo option is familiar to respondents and will likely have a smaller associated error (Scarpa et al., 2007; Train, 2003). On the other hand, hypothetical choices (non-status quo alternatives) are less familiar and choices depend in

part on an individual's ability to reason with the information presented, which supports the idea that correlation arises across choices from a particular individual. Hensher, Rose & Greene (2015) concur that an individual is likely to be consistent across choice tasks despite some impact from learning. Because this research uses a single alternative compared to a status quo alternative, there is no concern about correlation across alternatives with this specification (Hess & Daly, 2010; Yáñez et al., 2011).

The individual-specific error component added to the utility equation accounts for the unobserved influences on utility and therefore probability (Abdel-Aty et al., 1997). Error components have a mean of zero and a standard deviation of σ, which is estimated (Abdel-Aty et al., 1997; Bhat, 1999; Scarpa et al., 2007). This specification is used in both binary and ordered logit models (Bhat, 1999; Scarpa et al., 2007). Additional information about interpretation is discussed in *6.2.1 Results*.

6.1.2 Stated choice experiments with paratransit

In the PT field, SC experiments are typically used to determine demand for planned additions to the suite of transport options, such as a new rail line (McFadden, 1974). To estimate ridership for planning purposes, a SC experiment can ask respondents to choose a preferred mode. A probabilistic indication of modal split indicates potential demand to inform design and benefit-cost analysis of the investment. However, rather than determine user preferences, this study instead sought to determine the likelihood that a transport operator will provide a service.

Examples of measuring willingness to provide a service are limited in the literature across all fields. A number of cases involve assessment of uptake of farming conservation programs where farmers are presented with conditions that must be complied with in exchange for a specified level of compensation (Broch et al., 2013; Espinosa-Goded et al., 2010; Schulz et al., 2014). The choice model can predict the probability that farmers will accept the contract under varying combinations of conditions and compensation. A review of SC experiments in health economics (De Bekker-Grob et al., 2012) identified a few examples from the health field, mainly eliciting preferences of health professionals for varying characteristics of employment and remuneration, including pharmacists (Scott et al., 2007), general practitioners (Scott, 2001), and hospital consultants (Ubach et al., 2003). As employment in this field is focused on service provision, these examples were seen as somewhat analogous to this study.

An extensive review of the academic literature produced only one study that used SC methods with paratransit drivers as respondents. Li et al. (2011) conducted the experiment with paratransit drivers of various vehicle types in the Jabodetabek Metropolitan Area of Indonesia to determine whether a

driver of a particular vehicle type would choose to continue operating the current vehicle or switch to one of three other vehicle types. The study sought to inform a broad PT system redesign by determining, through driver preferences for vehicle type, the vehicle type proportions of the paratransit fleet that would exist under various policy interventions represented by the varying attribute level combinations. Knowing the proportions by vehicle type, officials could plan for the appropriate use of each vehicle type according to inherent benefits. While the method and respondent population are similar, the purpose of the study is fundamentally different than that of this study; rather than understand driver preferences for vehicle type/job, this study sought instead to understand how drivers might be induced to provide a specified quality of service in relation to a hybrid PT system.

An additional study was found that uses an ordered probit model to relate paratransit driver quality of life to various operational characteristics (Weningtyas et al., 2013). The purpose of the study was to determine the impact of minimizing operator and user cost on driver quality of life. Driver satisfaction was assessed on an ordered Likert-type scale and later linked to varying combinations of headway, service span, driver waiting time, and other factors using the ordered probit. SC methods were not used to collect or model the data and the study was not related to complementarity. However, the researchers' findings highlight the complicated nature of the paratransit industry. The modelling undertaken showed that minimizing operating and user costs did not necessarily improve frequency of service, and improved services for passengers does not always improve driver quality of life. While ensuring high quality of service for passengers is critical, driver working conditions and quality of life should also be considered in any intervention.

No studies were found that used SC methods with a paratransit operator respondent population in South Africa. Additionally, no studies could be found that used a SC experiment to assess operator willingness to provide service. This is likely because PT services are often provided by a single government body that can adjust service levels simply by realigning priorities, budgets, and operational decisions/contracts. However, in Cape Town and many other cities in low and middle income countries, MBT services are provided by a fragmented collection of individual operators that make operational decisions based on economic self-interest and on an individualized basis (McCormick et al., 2016). Implementing improved service within the city's proposed hybrid system requires an understanding of MBT operator willingness to provide service that meets passenger needs for service frequency and span complementarity.

6.1.3 Survey design

Once the problem is defined for a discrete choice experiment, the process of experimental design can begin. The fundamental components of the design are the alternatives, attributes, and attribute levels that will enable conclusions to be drawn about MBT willingness to provide off peak PT service. As the interest is determining whether drivers will provide service under particular conditions, only two responses are possible: *Yes* or *No.* These alternatives clearly point to a binary response format, but this study employed an ordered format, with response options expanded to *Definitely yes, Probably yes, Unsure, Probably no,* and *Definitely no* to provide additional information about preferences. Identification of attributes and levels involved a focus group discussion, review of the literature, and discussion with experts.

Prior to the focus group, I was introduced to the association leadership in person by supervisors who had engaged with the association on prior research. This was an important step towards maintaining and transferring established trust to me as a new individual to the association. I asked whether they would be interested in allowing me to engage with drivers and owners in a focus group and through later surveys with drivers and additional data collection with owners. Fortunately they were happy to allow this and were helpful throughout the process in organizing attendance, providing information, and coordinating route observations and other important peripheral data collection activities.

Following standard practice, a focus group discussion was organized to gain insight into factors MBT operators consider when choosing whether to provide service (Daly & Hess, 2014; Hensher et al., 2015; Train, 2003; Yang et al., 2009). A focus group serves as a way to understand the perspectives of decision-makers to inform not only attributes, but also survey instrument design. In particular, the use of particular terms or phrases was noted during the focus group to ensure the final instrument was understood by respondents as it was intended (Liamputtong, 2011). The group consisted of 10 individuals from Assoc A; four were owners (one of which was female), three were drivers, and three were owner-drivers (one of which was female). While the ideal group size is between six and eight (Krueger & Casey, 2015; Liamputtong, 2011), over-recruitment to ensure adequate participation led to a somewhat larger group than originally intended. Participants were selected by the association leadership based on researcher guidelines to ensure a diversity of positions (owner, driver, owner-driver). While this does introduce potential for biases to arise from leadership's influence on participant selections, this way of using those in the respondent community to recruit participants is accepted practice and can provide some legitimacy to the researcher when a request for participation comes from a known individual (Hennink, 2007).

Other issues arise from using focus groups where individuals have pre-existing relationships. Ethical issues arise from the lack of anonymity that participants have during the discussion, with the potential for unpopular opinions to be leaked either inadvertently or intentionally after the conclusion of the discussion (Krueger & Casey, 2015; Liamputtong, 2011). While some of the topics discussed were contentious, such as the use of CFC that evoked varying reactions from owners and drivers, the topics were generally not of a sensitive nature. Group discussions may also prevent individuals from expressing their opinions honestly if it means contradicting the majority opinion of the group (Liamputtong, 2011). Relationships between owners and drivers within the MBT industry are adversarial, analogous to the relationship between labor and capital in other industries; this may have led some participants to moderate their opinions or to withhold them completely.

As the principal researcher, I placed myself in the role of moderator of the focus group. There is some debate related to whether the moderator should be a member of the same sociodemographic class as the respondents, broadly defined. Similarities may make the group more comfortable and willing to share. However, my outsider status may have actually encouraged participants to provide more background and context with their statements as well as allowed me to ask for clarification on basic information without inducing annoyance (Hennink, 2007). Participants seemed eager to participate and forthcoming about their opinions.

To ensure ethics in research, information was provided to participants both verbally and in writing regarding the purpose of research, how responses would be used, and assuring anonymity when reporting any information collected during the discussion. A catered lunch was provided to compensate participants for their time during the two hour period (Krueger & Casey, 2015; Liamputtong, 2011), which included filling out sociodemographic questionnaires and obtaining informed consent signatures.

From analysis of the focus group notes, three attributes were clearly considered by drivers when choosing whether to provide service at a particular time. As expected, profit was a critical factor. Because the MBT industry operates as a private business with no operational subsidy, drivers consider whether demand is high enough to cover operating costs and profit. Security was also a clear concern among the group. Perception of criminal activity at the rank and in the surrounding neighborhoods is one factor that prevents service provision in the evening hours. Related to profitability, passenger loyalty was discussed as a factor in the decision to provide service. After prompting, it was explained that the association organized an internal incentive system to ensure early morning service is available to passengers even though the trips may be unprofitable for the drivers at such times. A single driver is scheduled to provide the early morning service for one day on a rotating basis. This

driver is then given the opportunity to make up the potential loss incurred from the early service via an additional departure from the rank in the morning peak period. Normally vans depart in the order in which they arrive back at the rank after running a round trip on the route; in this incentive system, the designated van that provided the morning service is allowed to jump to the front of the queuing vans to immediately run an additional trip that will likely be profitable enough to recoup the loss from the earlier trip. This system ensures that MBT service is available for passengers to arrive at the PTI early enough to transfer to the train and reach employment destinations on time. As a result, passengers theoretically remain loyal to the association by choosing to ride with Assoc A drivers rather than taking a competing association's MBT if it arrives first on the route. The system appears to be working as 77 percent of Assoc A passengers indicated they would wait for an Assoc A vehicle rather than use a competitor where routes overlap; for other associations in Mitchells Plain, less than 20 percent of passengers expressed such a loyalty (Behrens et al., 2018).

Factors considered by drivers when choosing to provide service are one component of the choice experiment. To test various mechanisms for addressing known issues in transfer quality in this location, additional attributes needed to be included. The primary issue facing passengers transferring between trunk modes and MBT service provided by Assoc A is a mismatch in service span where MBT services end by 7 pm while trunk services continue until almost 10 pm (Behrens, Hawver, et al., 2017). To test mechanisms for addressing this issue as well as to incorporate security concerns highlighted by the focus group (as security concerns were particularly related to evening hours), the SC experiment was designed to ask drivers whether they would provide service from 7 pm to 10 pm under the dictated conditions. To implement some of the incentive mechanisms to induce drivers to provide service, CFC technology would be required in some interventions as described in chapter 5 (*Interventions*). Therefore, it was necessary to include fare payment type as an attribute. While earlier research did not find that headways between departing vans (passenger waiting time) was particularly problematic, expected lower demand in the evening hours may mean that headways do become problematic. This is an issue both for drivers and passengers who must spend more time waiting for departures.

The attributes chosen also allow assessment of transfer quality in alignment with the literature recommendations for best practices in PT transfers. In researching paratransit services in Puerto Rico, Lau (1997) suggests that a key method for improving service is to ensure guaranteed hours of service, particularly in the evening. This recommendation is particularly relevant for this study, where MBT service is not generally available in the evening. For passengers to complete a full journey, this feeder/distributor service must be available. Passengers in the United States perceive one minute of

transfer time as two and a half minutes of in-vehicle time, suggesting that minimizing transfer time is essential to improving PT quality of service in general, but particularly related to transfers (Transportation Research Board, 2013). By ensuring short headways through an intervention in the MBT business model, passenger journey time will be improved both in real and perceived terms.

For the security attribute, levels were clearly enunciated from the focus group while other attribute levels, such as profit, were determined by a method of triangulation between unstructured discussion with drivers, data exchange with others who have undertaken research on the MBT industry in South Africa, and by calculation. I visited the rank repeatedly to talk in an unstructured way with drivers over the course of five months to understand driver costs and revenue to determine reasonable levels for profit. Repeated visits built trust and drivers were more willing to speak openly with me during later visits and I believe this same goodwill translated to administration of the survey later in the process. Fare payment levels were straightforward (cash or cashless) and headway levels were based partly on previous departure time data (Behrens, Hawver, et al., 2017) and literature. Local experts consulted ranged from researchers at UCT and elsewhere who have worked with the MBT industry for many years, those within the MBT industry in other associations, consultants, and City officials working with the industry both directly and in a planning capacity.

Literature provides guidance for designing and conducting SC experiments in general (Daly & Hess, 2014; Hensher et al., 2015; Train, 2003). However, for this particular application, more specific guidance was needed to design an experiment appropriate for a respondent population that speaks additional languages than the principal researcher and may be less formally educated.

For respondents with limited literacy, SC experiments can be designed with pictorial or visual attribute levels as opposed to tabular text. However, a study conducted regarding SC experiment validity comparing text to visual representation of alternatives found that visual aids did not significantly impact the estimated parameters, suggesting the effort required to develop a visual questionnaire is not worthwhile (Arentze et al., 2003). Regardless, from engagement with the respondent population prior to the survey being conducted, it was decided that the driver population is not of limited literacy and therefore text-based choice cards would be appropriate.

The decision to use a text-based questionnaire meant terminology used would need to be carefully designed to ensure respondents understood concepts as intended by researchers (Mangham, Hanson, & McPake, 2009; Venter & Venkatesh, 2010). The unstructured discussions with drivers mentioned earlier also served as an opportunity to note how particular elements of the MBT industry were discussed. This unstructured data-gathering process, an appropriate alternative to structured

interviews (Gillham, 2000), fed directly into questionnaire design and terminology was later confirmed in a meeting with the MBT association leadership. As these individuals were intimately involved with the particular context of the association from which driver respondents would be sourced, but would not be taking the survey, they were instrumental in refining terminology. Unstructured data-gathering also allowed me to build trust among drivers of the association; while a relationship existed between researchers and association leadership, this does not necessarily extend to drivers so this relationship also had to be built.

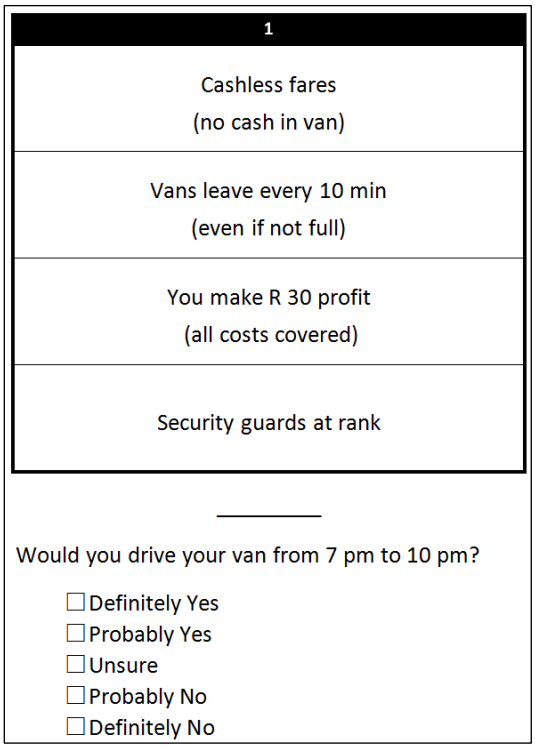
With the instrument designed and refined through a pre-pilot with UCT students and staff, a pilot survey was conducted with four individuals from Assoc A. Coordination for this and other later focus groups and data collection efforts usually required an in-person visit to schedule and ensure they were aware of my intentions; in other cases phone calls might suffice if the request was simple. However, for most situations that require coordination, time needed to be spent visiting in person which was sometimes a cause of delay. All questionnaires were on paper to reduce costs and the risk of robbery of data collection devices. After the pilot survey was completed, the principal researcher interviewed the four individuals to confirm consistent understanding of terminology used. For example, for Assoc A the attribute levels requiring a driver to leave after 10 or 20 minutes were explained using the association's own system of leaving the rank with only 10 passengers on Sunday. This is done to reduce wait times on a day with low demand. This concrete reference to an existing practice in the association served as a way to clearly communicate the attribute levels for an element that is otherwise unusual in the MBT industry (leaving without a full load). The pilot resulted in the deletion of the passenger loyalty attribute because three of the four individuals stated they ignored this attribute in a standard question asked at the conclusion of the experiment. This was an unexpected finding considering the focus group discussion as well as the finding by Behrens et al. (2018) that 77 percent of Assoc A passengers stated they would wait for an Assoc A van rather than take a competitor's vehicle if it arrived first. While passenger loyalty is strong according to passengers' stated intentions and drivers stated they consider this factor during the focus group, it seemed that among other attributes presented, it was only a minor consideration. The four attributes included in the final instrument are listed in Table 11.

Table 11. Attributes included in the final instrument.

Attribute	Type	Number of levels	Attribute levels
Total profit 7 pm to 10 pm	Variable	6	You make R [30, 40, 50, 60, 70, 80] profit (all costs covered)
Protection from criminal activity	Dummy	2	• Security guards at rank • Armed SAPS at rank
Fare payment system	Dummy	2	• Cash fares • Cashless fares (no cash in van)
Van departures from the rank	Dummy	3	• Vans leave when full • Vans leave every 20 min (even if not full) • Vans leave every 10 min (even if not full)

There were a number of detailed design decisions for the final survey instrument related to task complexity, attribute dominance, and attribute levels. Van Zyl, Lombard & Lamprecht (2001) reviewed five SC experiments conducted in South Africa, each presenting only two alternatives per choice set. Accordingly, this study sought to reduce respondent burden by simplifying the choice sets as much as possible while still gathering required information. Final choice sets presented one unlabeled alternative asking the question, "Would you drive your van from 7 pm to 10 pm?" Responses were Likert-type: *Definitely yes, Probably yes, Unsure, Probably no, Definitely no*. This allowed respondents to focus on the information of just one alternative while providing data to enable two alternatives to be estimated (yes and no) in a binary logit or as an ordered logit using the Likert-type responses. An example choice card is shown in Figure 20. Each card/alternative presents four attributes: fare payment, departure schedule/headway, driver profit, and security provision at the rank.

Figure 20. Example choice card used in the study.



A number of studies have considered the impact of task complexity on SC experiment results. Caussade et al. (2005) conducted a study in Santiago, Chile that found the greatest impact on WTP and model estimates resulted from the number of attributes with the second largest impact stemming from the number of alternatives. Arentze et al. (2003) found a significant increase in error variance when increasing the number of attributes from three to five and Chintakayala et al. (2009) found that experiments with six attributes increased response randomness. These studies support the efforts to reduce the total number of attributes to a total of four and to present only a small number of alternatives in a choice set.

Additionally, Caussade et al. (2005) found the factor that least affected WTP and model estimates was the number of choice sets, supported also by Arentze et al. (2003) that found no increase in error variance when respondents were presented with sixteen choice sets compared to eight. This study presented respondents with 12 choice sets, which is supported by these studies and also by the fact that each choice set is simpler than those in many SC experiments that present two or more alternatives per set. Nguyen et al. (2015) found that stated preferences were stable from choice task four, suggesting that a large number of choice tasks may actually contribute to higher quality data by providing more opportunity for choices to stabilize and reflect in the resulting data.

A particularly problematic feature of this study was the expected dominance of the monetary attribute. Considering the unsalaried nature of the MBT industry, drivers are particularly concerned

about their earnings and are likely to consider this attribute foremost. Kjær et al. (2006) found dominant behavior is equivalent whether a monetary attribute is placed first or last in the list of attributes, increasing price sensitivity by a factor of 1.42. Therefore, the monetary attribute was placed third among the four attributes in an attempt to reduce dominance.

Related to the monetary attribute, Hensher, Rose & Greene (2015) suggest respondents' choices are influenced by attributes in previous choice sets. In this case, if respondents were presented with a high-profit alternative in the first set, they would be less likely to respond *Definitely* or *Probably yes* in remaining sets. Conversely, they would be more likely to respond positively if presented with a low-profit alternative in the first set. To counteract the dominance of profit and ensure all respondents were presented with consistent information, choice set order was randomized, but adjusted so that all first choice sets presented profit attribute levels of the lowest two values.

Attribute levels were also adjusted from the pilot to maximize trade-off behavior among respondents. Values at the low (high) end of the profit level range were consistently *no* (*yes*) responses, suggesting that the range of values was too wide to be realistic. The full survey version used a narrower range of values. Values were difficult to estimate due to the nature of the industry where target values, fuel and maintenance costs, and other elements of the business are not as well-documented as they would be in a registered company. As drivers may underreport their earnings in a commission system or may be convinced that research is part of a MyCiTi buyout assessment, there are a multitude of valid reasons for misreporting revenue and profit as I was engaging with drivers. Compared to a standard SC experiment that considers an individual's mode choice based on trip cost where cost is simply the cost of fuel and tolls or of PT fare, there is a wide variety of costs to consider in the MBT industry. These include lines fees (paid either by the driver or the vehicle owner), conductor wages (if the driver runs with a conductor), and fuel and target (both of which vary by vehicle type).

With attributes and levels finalized, Ngene software was used to construct the experimental design, which refers to the allocation of the attribute levels to create the alternatives displayed in choice sets shown to respondents. All dummy variables were dummy coded, which provide equivalent results to effects coding (Daly et al., 2016). While many studies have used orthogonal designs in the past (Rose & Bliemer, 2009), this design type was unlikely to yield enough statistical power with the small expected sample size. D-efficient designs are particularly useful in situations with small sample sizes because they seek to maximize the amount of information produced from each choice set by selecting the optimal combination of attribute levels (Rose & Bliemer, 2009). The goal is to avoid easy choice situations that do not force respondents to make tradeoffs because these data points provide little to no information about preferences.

To ensure a more appropriate allocation of attribute levels, prior parameter estimates are used to indicate to the design software some additional information. In this study, the prior parameter estimates were taken from the pilot survey. Of the four attributes, only profit was given a prior parameter estimate because it was the only significant parameter from the pilot model estimation. The value of 0.01 was selected. Other priors were set to zero. The twelve choice sets created by Ngene were manually checked to ensure the attribute level allocations created situations involving tradeoffs. The resulting design had a d-error of 0.391308. This is an acceptable design as d-errors above one are considered to be poor designs, though only designs for the same experiment can be compared (Hensher et al., 2015). Fortunately, d-efficient designs are resilient even if priors are mis-specified.

6.1.4 Survey administration

The survey was administered in two stages. Assoc A drivers were surveyed in mid-October 2017 across three days (Tuesday through Thursday), while Assoc B drivers were surveyed on a Monday and Tuesday in late November 2017. Surveys took place after the morning peak period, from approximately 10 am until 2 pm. The choice cards used were consistent across the associations, allowing aggregation of the responses into a single model. While some differences exist between the associations, as discussed in chapter 3 (*Research Context*), both associations operate feeder routes from the same PTI with fares that are similar. Minor wording changes were made for the second administration to address issues from the first. For example, the description of the profit attribute was adjusted to make clear that it is possible to leave with less than a full load yet still receive the amount listed.

Professional surveyors were hired for both stages. The team leader remained consistent, though the members of the team did change. However, all surveyors were trained prior to administration and I was present during administration to address any questions or issues. Data from paper survey sheets was captured by staff from the same survey company and I verified 100 percent of responses from the original paper surveys.

Surveyors were fluent in Afrikaans and/or isiXhosa to ensure full understanding by respondents (Van Zyl et al., 2001). The vast majority of respondents seemed to prefer communication in either English or Afrikaans, though some respondents from Assoc B preferred isiXhosa. Interviewers were fluent in Afrikaans and in the case of Assoc B, one was fluent in isiXhosa. The option was provided for respondents to take the survey with text translated into Afrikaans, though no respondents selected this option. While this may be because respondents were comfortable in English, it may also stem from the need for them to have made an active choice to switch from English to Afrikaans, as English

was presented as the default option. For future surveys, it may be beneficial to force respondents to select what language they are most comfortable with without providing any default option (Johnson & Goldstein, 2003).

Assoc A operates from three ranks including the home rank at the PTI, Westgate Mall, and Liberty Promenade Mall. This complicated administration to some degree by requiring surveyors to move between these locations to find drivers who had not yet been surveyed. Because Assoc B drivers were surveyed at the end the month, the rank was busy; some surveys were interrupted by bystanders or as drivers moved up in the queue. As much as possible for both associations, drivers were interviewed in empty vans in the queue to reduce distraction and ensure privacy.

6.2 Choice modelling analysis

6.2.1 Results

As described in chapter 3 (*Research Context*), survey respondents were sourced from two associations operating from the Mitchells Plain PTI. These associations were selected from 102 associations registered in Cape Town. Because this research looks specifically at complementarity between scheduled trunk and unscheduled feeder (paratransit) services, only associations operating feeder services were eligible to be included in the SC survey. Of all surveyed routes in Cape Town, 50 percent are estimated to be feeder routes (Du Preez et al., 2019). However, associations often operate more than one route; assuming each operates an average of two routes, there are approximately 25 associations operating feeder services in the city. Despite this seemingly large sampling frame, the major limitation for research with the MBT industry is the contentious nature of MBT regulation and reform and the potential for conflict, as discussed in chapter 2 (*Literature Review*). Researchers had an established relationship with the two associations surveyed from previous research and a capacity-building program facilitated by a colleague. This provided a foundation of trust that enabled this research. Previous research findings also provided understanding of complementarity issues that allowed this solution-focused research. Because of the pressing issue surrounding the role of MBTs as feeders in a hybrid network as a result of the city's change in planning paradigm, I felt it was important to investigate potential solutions using the positive working relationship with these particular associations rather than attempt to sample from all feeder associations. Therefore, this research makes no claim that results are representative of feeder associations in general and rather seeks to capitalize on a well-understood example to inform future PT policy and planning.

Across the two associations, the driver and owner-driver population was estimated by association leadership to be 123 individuals. According to Johnson & Orme (2003), the survey design used here

with 12 choice tasks, two alternatives, and six levels for the profit attribute and interested only in main effects requires 125 respondents. Therefore, the survey was intended as a census of Assoc A and Assoc B drivers and owner-drivers. Unfortunately, the fluid nature of the MBT industry made it practically impossible to reach all 123 individuals, assuming this was an accurate estimate; after many days of survey administration, no additional respondents could be found at any of the ranks.

Characteristics of respondents are listed in Table 12 for each association separately as well as in aggregate. Note that the total number of respondents in the aggregate column is one less than expected; this is due to the fact that one respondent left all choice tasks blank. Descriptive characteristics listed separately for each association include all 79 respondents. The respondent populations across each association are quite similar, with average age the only characteristic that shows major differences. This is not unexpected considering the associations operate in close proximity. Because the survey was conducted as a census of the two associations, no comparison data is provided to determine whether the sample is representative of the whole. Assuming the total population estimate by association leadership is correct, the survey reached 78% and 56% of the total drivers and owner-drivers at Assoc A and Assoc B respectively.

Table 12. Characteristics of respondents.

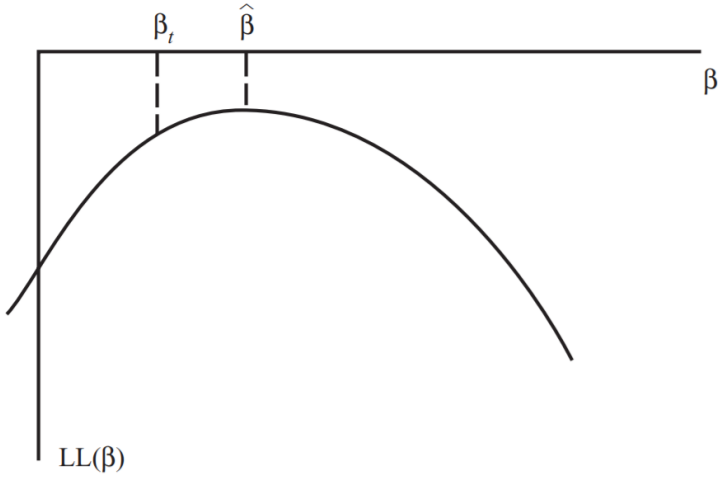
Characteristic	Assoc A	Assoc B	Aggregate
Total respondents	35	44	79
Percent male	92%	98%	95%
Average age	53 years	44 years	49 years
Percent drivers (v. owner-drivers)	78%	100%	90%
Average household size	4.9	4.8	4.7

Both binary and ordered logit panel models were estimated using an error component specification to account for the correlation in unobserved elements across responses given by a particular individual (Abdel-Aty et al., 1997; Revelt & Train, 1998). The ordered logit model was estimated using aggregate data that included 889 total observations across 78 respondents (59 choice tasks were left blank and therefore were excluded). The binary logit model was estimated using 864 total observations across 78 respondents with the same 59 choice tasks excluded as for the ordered logit, with an additional 25 choice tasks with a response of *Unsure* also excluded. The respondent population for each association individually is small; therefore the aggregate data set was used to provide greater statistical power.

Estimation was completed using simulated maximum likelihood in the Biogeme software, Pandas version (Bierlaire, 2018). For parameters specified linearly, McFadden (1974) showed the log likelihood function to be globally concave; this means parameter values that maximize the function will result in the smallest negative value of log likelihood and provide the best fit for the data (Train,

2003). Figure 21 uses a simplified visual to demonstrate how the parameter values β in the utility function are iteratively improved from β_t until the function is maximized at $\hat{\beta}$.

Figure 21. Simplified graph of log-likelihood function (Train, 2003).



A binary logit model was estimated for all five parameters (the attribute pertaining to time between departures at the rank, or headways, was coded to allow for non-linear relationships between the three levels). An ordered logit model was estimated for all five parameters as well as the threshold values τ that indicate the division between response categories. τ values are calculated after model estimation using the delta (δ) estimates ($\tau_2 = \tau_1 + \delta_2$ and so on) produced by Biogeme. As shown in Table 13, only the parameter estimates for the Alternative Specific Constant (ASC), profit, and σ are significant in the binary logit. The ordered logit results in significant estimates for these as well as the level of rank security and deltas.

Table 13. Parameter estimates for full binary and ordered logit models.

	Binary logit				**Ordered logit**			
Parameter	**Estimate**	**Std error**	**t-test**	**p-value**	**Estimate**	**Std error**	**t-test**	**p-value**
ASC (provide service)	-3.78	0.964	-3.92	0.00*	-2.07	0.679	-3.05	0.00*
Fare payment	-0.0268	0.27	-0.099	0.92	-0.0172	0.14	-0.12	0.90
Headway (20 min)	-0.353	0.303	-1.16	0.24	0.156	0.173	0.906	0.37
Headway (10 min)	-0.337	0.366	-0.919	0.36	0.116	0.199	0.58	0.56
Profit	0.0842	0.0154	5.46	0.00*	0.0532	0.00751	7.09	0.00*
Security	0.262	0.371	0.705	0.48	0.412	0.176	2.35	0.02*
σ	5.33	0.951	5.6	0.00*	3.56	0.482	7.38	0.00*
τ_1 (fixed)					0	-	-	-
δ_2 (τ_2)					0.937	0.237	3.95	0.00*
δ_3 (τ_3 = 1.232)					0.295	0.0831	3.55	0.00*
δ_4 (τ_4 = 2.982)					1.75	0.253	6.9	0.00*

Notes:
– Standard errors, t-tests, and p-values refer to robust versions of each.
– * indicates statistical significance at the 5% level or greater.

Additional binary and ordered logit models were then estimated to explore outcomes. The reduced models highlighted here use only the profit and security attributes (Table 14). In the ordered logit both parameters are significant while in the binary logit only profit is significant (plus the ASC and σ).

The reduced binary logit model achieves a slightly worse fit based on final log-likelihood (Table 16). However, the adjusted Rho-square value, Akaike Information Criterion (AIC), and Bayes Information Criterion (BIC) values improve compared to the full binary logit (Greene & Hensher, 2008). The reduced ordered logit model shows improvement over the full model in final log-likelihood, AIC, and BIC. Only the adjusted Rho-square does not improve for the reduced model.

Because model performance was somewhat ambiguous between the full and reduced binary models, an additional profit-only binary regression was run, with results in Table 15. Performance of this model improves on three measures as shown in Table 16. The profit-only ordered regression performed worse than the reduced ordered model for final log-likelihood, AIC, and BIC and had the same adjusted Rho-square.

Table 14. Parameter estimates for reduced (profit and security attributes only) binary and ordered logit models.

	Binary logit				**Ordered logit**			
Parameter	**Estimate**	**Std error**	**t-test**	**p-value**	**Estimate**	**Std error**	**t-test**	**p-value**
ASC (provide service)	-3.96	1.06	-3.73	0.00*	-1.58	0.621	-2.54	0.01*
Profit	0.0835	0.0151	5.54	0.00*	0.0533	0.0075	7.11	0.00*
Security	0.279	0.371	0.752	0.45	0.406	0.175	2.32	0.02*
σ	5.22	0.923	5.66	0.00*	3.69	0.483	7.63	0.00*
τ_1 (fixed)					0	-	-	-
δ_2 (τ_2)					0.936	0.236	3.96	0.00*
δ_3 (τ_3 = 1.232)					0.296	0.0833	3.56	0.00*
δ_4 (τ_4 = 2.982)					1.75	0.254	6.89	0.00*

Notes:
– Standard errors, t-tests, and p-values refer to robust versions of each.
– * indicates statistical significance at the 5% level or greater.

Table 15. Parameter estimates for profit-only binary and ordered regressions.

	Binary logit				**Ordered logit**			
Parameter	**Estimate**	**Std error**	**t-test**	**p-value**	**Estimate**	**Std error**	**t-test**	**p-value**
ASC (provide service)	-3.36	1.5	-2.24	0.02*	-1.69	0.617	-2.74	0.01*
Profit	0.0831	0.0145	5.71	0.00*	0.0528	0.00743	7.11	0.00*
σ	4.79	0.82	5.84	0.00*	3.73	0.488	7.64	0.00*
τ_1 (fixed)					0	-	-	-
δ_2 (τ_2)					0.936	0.238	3.93	0.00*
δ_3 (τ_3 = 1.232)					0.296	0.0829	3.58	0.00*
δ_4 (τ_4 = 2.972)					1.74	0.254	6.83	0.00*

Notes:
– Standard errors, t-tests, and p-values refer to robust versions of each.
– * indicates statistical significance at the 5% level or greater.

Table 16. Statistics compared for full and reduced models.

	Binary			Ordered		
	Full	**Reduced**	**Profit only**	**Full**	**Reduced**	**Profit only**
Number of observations	864	864	864	889	889	889
Individuals	78	78	78	78	78	78
Initial log-likelihood	-598.879	-598.879	-598.879	-2005.460	-1988.793	-1992.95
Final log-likelihood	-293.560	-295.3085	-295.9609	-847.213	-846.670	-849.4293
Adjusted Rho-square	0.498	0.500	0.501	0.573	0.571	0.571
AIC	601.120	598.617	597.922	1714.427	1707.340	1710.859
BIC	617.617	608.044	604.992	1737.994	1723.837	1724.999

Across all estimated models, the ASC is highly significant and negative indicating that unobserved components of utility contribute to respondents generally preferring the status quo alternative. This represents the choice to not provide additional evening trips, ending MBT services around 7 pm. The significance of σ indicates there is correlation across an individual's repeated choices, which aligns with expectations for SP data. The size of σ suggests there is considerable heterogeneity in preferences across those drivers and owner-drivers who responded to the survey.

In response to a survey question asking each respondent what attributes they considered throughout the choice sets, it is clear that profit and security were much more frequently considered than fare payment and headway (Table 17). This suggests that the reduced models align with how respondents considered the choice tasks despite the fact that the reduced models do not show improvement according to every measure. As a result, and because the SC survey was designed as ordered, the reduced ordered model was selected for further analysis.

Table 17. Percent of respondents considering each attribute across choice tasks (self-reported).

Attribute	Percent of respondents considering the attribute
Fare payment	27%
Headway	32%
Profit	75%
Security	67%

The primary purpose of the study was to determine what would be required to induce drivers and owner-drivers to provide service from 7 pm to 10 pm when service is not currently provided. The probability of a driver's willingness to provide service can be calculated for each of the response categories offered in the survey (*Definitely no, Probably no, Unsure, Probably yes, Definitely yes*) as detailed in *6.1.1 Choice modelling background*. Because only the profit and security attributes were significant, analysis is restricted to these two variables. Using the reduced ordered model, Figure 22

shows the change in probability of a particular response as the profit amount increases when private security guards continue to be located at the rank. Figure 23 shows the change in probability when an armed SAPS officer is stationed at the rank. Patterns are similar; however, the probability of a driver agreeing to provide service is higher for a given profit level when SAPS is stationed at the rank. Exchange SAPS for private security, and the probability of drivers agreeing to provide service is lower for the same amount of profit.

Figure 22. Probability of responses with private security guards at rank.

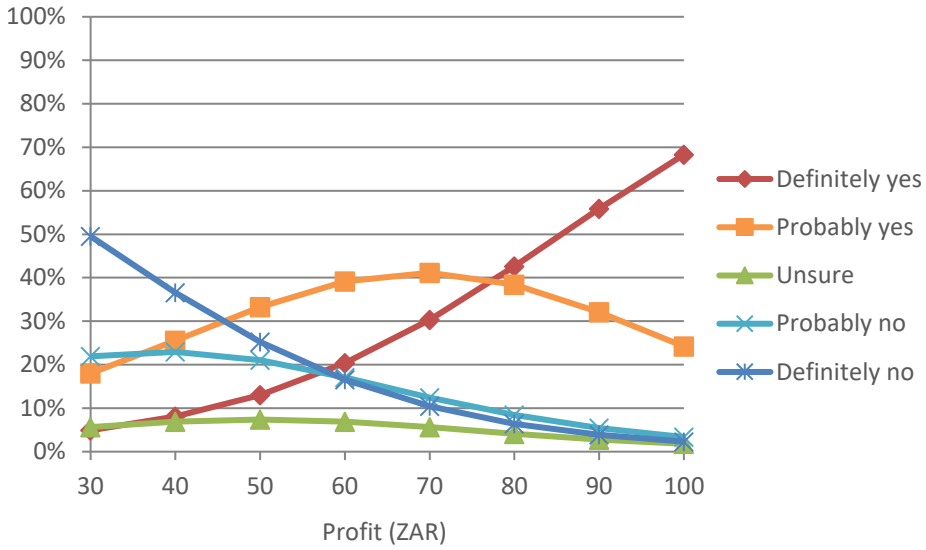
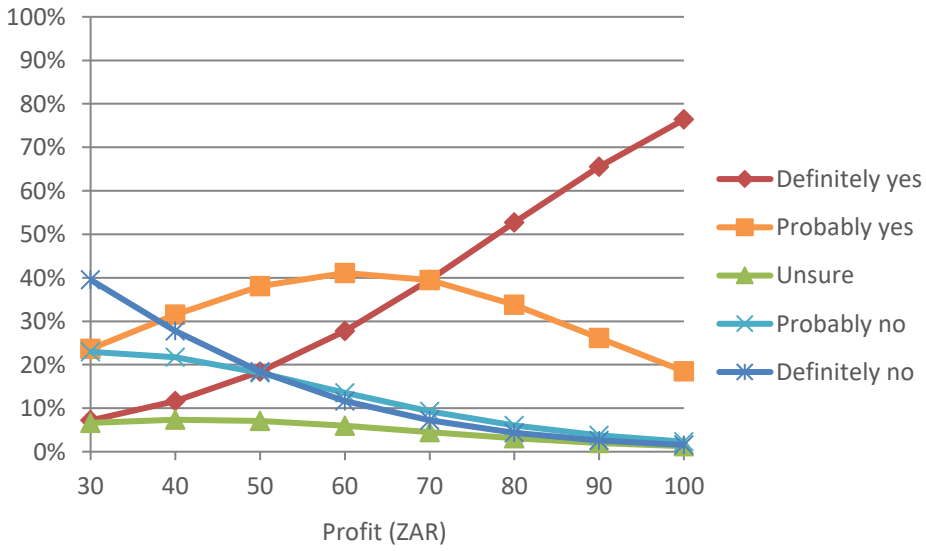


Figure 23. Probability of responses with armed SAPS officer at the rank.



To obtain a 70% chance of drivers agreeing to provide service (combining the probabilities for being in either *Probably yes* or *Definitely yes* categories), MBT drivers and owner-drivers from the associations surveyed would require the presence of SAPS at the rank and ZAR 61.04 profit from 7 pm to 10 pm.

Without the presence of SAPS, ZAR 68.66 profit would be required to maintain the same probability of a driver agreeing to provide service. In both cases, there is a 29% chance of a driver responding *Definitely yes* and a 41% chance of responding *Probably yes*.

The difference in required profit with and without SAPS indicates the WTA value of ZAR 7.62. This is the value placed on additional security provided at the rank; if no SAPS officer is present, drivers would need to be compensated an additional ZAR 7.62 to maintain the same probability of service provision as when a SAPS officer is present.

The survey also asked basic information about respondents to understand how sociodemographic characteristics might influence choices. This information is interesting, but will not be used for policy applications because public authorities will likely not spend the additional resources to survey each association's membership to determine differential payments based on these characteristics. In doing so, they may invite discrimination lawsuits and will very likely cause tension between members who received varying amounts. Therefore, only basic analysis was completed using sociodemographic data.

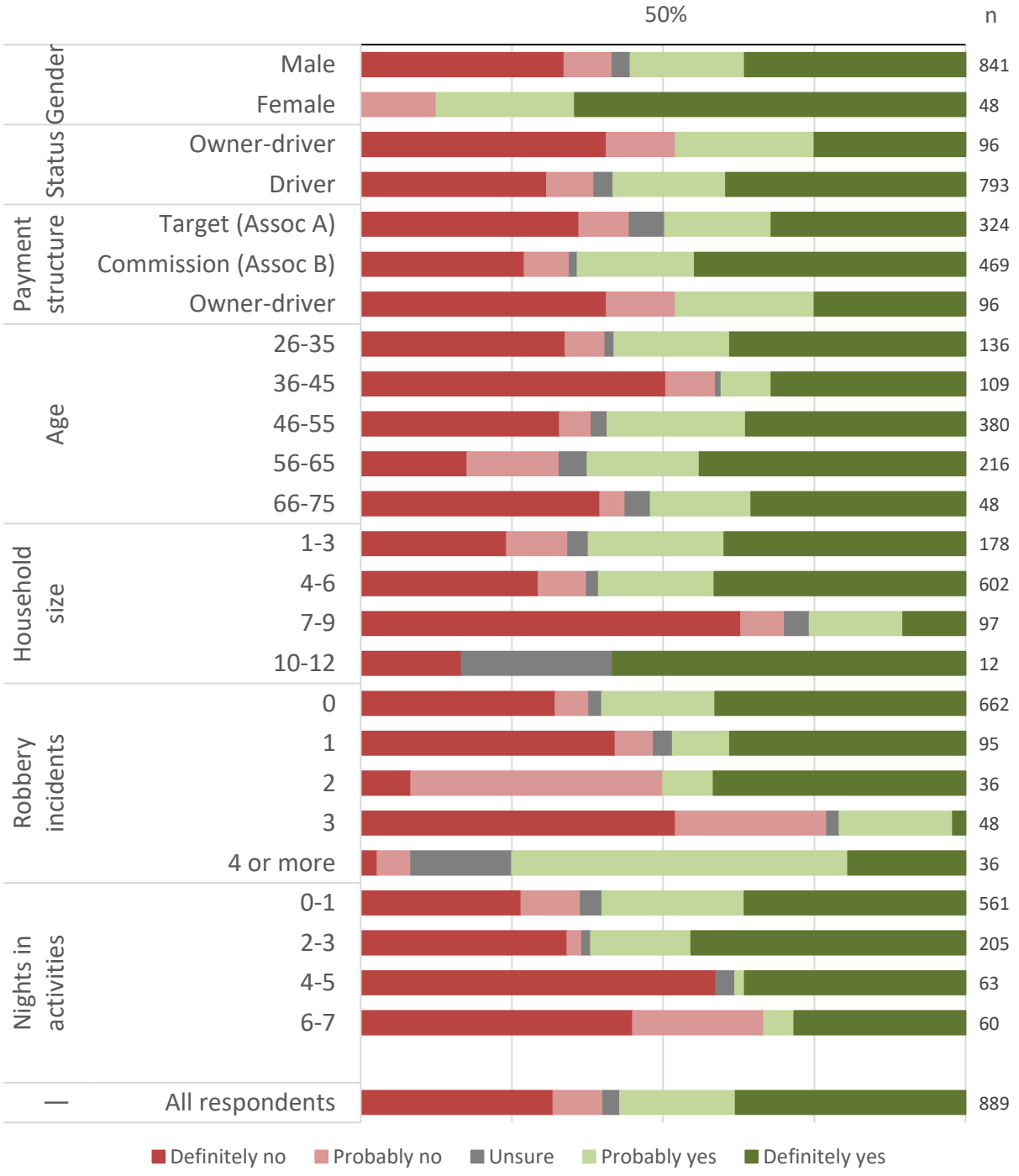
Figure 24 shows how the various characteristics impacted choices. Only four females were surveyed–three from Assoc A and one from Assoc B–but they are more likely to provide evening service than the males surveyed. One female from Assoc A specifically stated that service ends too early, and that 9 pm would be a more appropriate end time. Owner-drivers (all eight of whom are members of Assoc A) are less likely to drive later than drivers; this may be because they have fewer expenses without a daily target or commission and are more satisfied with earnings from the day than drivers. Within the pay structure comparison, owner-drivers are again the group least likely to provide additional evening service. Other results related to pay structure seem counterintuitive, where drivers on a commission system (total earnings are used to pay fuel and conductor and remaining amount is split 30 percent to the driver and 70 percent to the owner) might be expected to be less likely to drive because of the unfavorable division of revenue, whereas drivers on the target system might be able to reach their target during the day and keep all evening profit for themselves.

Owner-driver/driver age does not appear to have a large impact on choice responses; those aged 36-45 years or over 65 are less likely to drive. Older drivers may not want to drive longer hours perhaps because of fatigue, but the results for younger drivers are unexpected. A similar effect appears in household size data, with only the 7-9 group showing major differences (much less likely to drive). However, this group is relatively small. It might be expected that larger households would lead to greater pressure for earnings from owner-drivers/drivers, though this was not shown in the data.

Most respondents have not had a single robbery incident in the past year, which is surprising considering responses from the focus group used to design the survey. Participants almost unanimously agreed that safety and security were major issues in the area, particularly at night. Being cash-based businesses, drivers consider themselves targets at the end of the day if cash is not deposited. However, it may be that perception of risk is greater than actual risk, or that robbery is not as problematic compared to other risks such as gang-related violence. Generally, choice task responses align with expectations that more robberies would reduce driver willingness to drive into the evening. Observations in the 4 or more category defy this logic.

Individuals involved in activities more nights per week are less likely to agree to drive into the evening though it may be hard to draw conclusions when such a large proportion of responses fall into the first two categories.

Figure 24. Impact of sociodemographic characteristics on choice-making behavior.



Note: n refers to observations rather than individuals

6.2.2 Discussion

That respondents considered the fare payment and headway attributes much less frequently than the profit and security attributes suggests that respondents care relatively more about profit and security. This may indicate a form of attribute processing, or response heuristic, called elimination by aspects. Respondents narrow down choices by determining the most important attribute and a threshold value below which they will respond a particular way (Hensher et al., 2015). If a respondent considers

the profit attribute most important and the value is too low, responses will be *Definitely* or *Probably no*. Anecdotal situations of this heuristic being used is with CFC, particularly for respondents in Assoc B. These drivers operate on the commission system and some indicated that they underreport revenue to avoid splitting it with the owner. A CFC system would prevent this and possibly reduce take-home pay, leading some respondents to state that they would respond no to any card with CFC.

The fact that respondents frequently ignored fare payment and departure schedule may be because, as attributes, they deviate from standard choice experiment design. Attributes are usually included because respondents consider them when making a choice, but fare payment and departure schedule are not attributes drivers normally consider when deciding to provide service because they are not currently a part of the business. These attributes were necessary to assess driver willingness to accept quality of service requirements and so were included, but the fact that many respondents ignored them should not be particularly surprising in hindsight.

Related to the departure schedule attribute, respondents often found it hard to conceptualize leaving the rank with anything less than a full van. This is a fundamental part of the business and a quick way to assess how much money will be made for that trip. Because of this, it was difficult for respondents to reconcile the requirement to depart every 10 or 20 minutes with the profit amount shown as these were almost duplicative indications of viability. MBT drivers and owner-drivers are experts in their business and understand the relationships between passenger numbers and their own profit; to conceptualize a profit and departure combination that was unrealistic in the current reality was difficult. One possibility for counteracting this effect may be to explicitly state the potential for outside funds to cover the cost of empty seats.

From unstructured discussions with drivers and owner-drivers and the focus group, it is clear that demand fluctuates over the course of the month. The beginning and end of the month are busier than the intervening weeks. Surveys were conducted in mid-October 2017 for Assoc A and at the end of November 2017 for Assoc B. Therefore, it is possible that estimations of revenue may be low for Assoc A and high for Assoc B, with the possibility that the aggregate median value fairly well approximates the gross revenue of operators in these two associations. Survey administration timing may also have impacted respondent reactions to profit amounts on choice cards. One driver commented during the survey that because demand fluctuates over the month, drivers would be more willing to provide evening service during periods of lower demand.

Profit values were occasionally misunderstood for revenue, with respondents beginning to subtract fuel costs from the profit value on the choice card. As much as possible interviewers corrected

misunderstanding, though may not have recognized or corrected all instances. Great care should be taken to ensure understanding of this attribute because it is clearly the most important.

Despite driver pay being divorced from hours worked, putting the required compensation values in terms of hourly rates is helpful for comparing to benchmarks such as the minimum wage. With (without) SAPS, ZAR 20.35 (ZAR 22.89) per hour is required to ensure a 70% chance of drivers agreeing to provide service. Prior to passage of the National Minimum Wage Act in November 2018, the minimum wage for MBT drivers as specified by the National Department of Labour was ZAR 15.47 (Department of Labour, 2016), which aligns closely with the ZAR 15.52 profit per hour drivers currently earn based on the aggregate median daily profit of ZAR 225 divided by the 14 and a half daily working hours reported in the focus group. However, the new minimum wage for all workers is now ZAR 20, which more closely aligns with the hourly wage suggested by the choice modelling results (National Minimum Wage Act, 2018). The somewhat higher amount for evening service provision suggested by the survey (approximately 1.32 – 1.48 times the previous minimum wage, 1.02 – 1.14 times the current minimum wage, and 1.31 – 1.47 times the current median hourly earnings) could be due to a number of factors, including the security risk drivers perceive both at the rank and along the route. SAPS may mitigate this risk at the rank, but do nothing to reassure drivers while on the route. Working evening hours also requires foregoing family time or other activities that may lead drivers to demand additional compensation, which the sociodemographic results discussed above suggest.

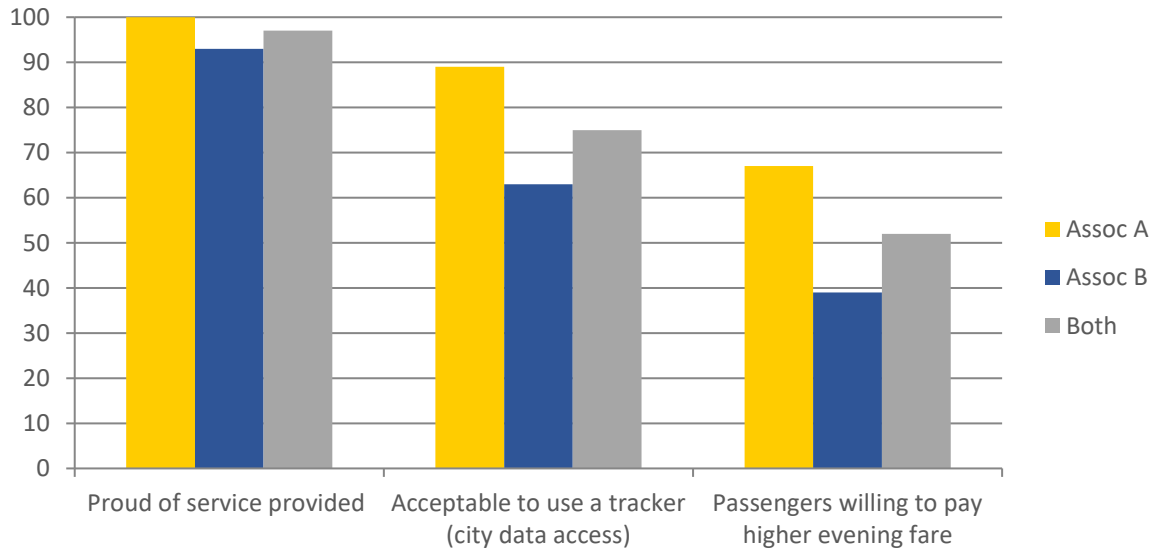
Additional support for the importance of family time is given by the responses to the example choice card included in the survey. Because the format of a SC survey was likely new to respondents, an example choice card was included asking whether respondents would go to a park based on distance to the park, entrance fee, and whether braai spots were available. The choice card was designed to elicit “No” responses with the hope that it would act as a test of understanding; if individuals responded yes unexpectedly, interviewers could re-explain the format before beginning actual data collection. However, many individuals responded yes to this example choice card and when interviewers attempted to correct misunderstanding through an additional explanation, respondents made clear that they understood. Some added additional information to their response which suggests that the park trip was valuable time with their family and that despite unfavorable attribute levels, family time was important.

6.3 Non-choice data

In addition to the sociodemographic characteristics, the survey asked about various topics related to the MBT business. The results are summarized in this section.

An overwhelming majority of Assoc B respondents and all Assoc A respondents are proud of the service they provide (Figure 25). Many individuals have been in the MBT industry for many years and know they serve a key community need. Overall, 75 percent of respondents would agree to have a tracker installed on the vehicle even if the City is able to access the data. Only 52 percent of individuals said passengers would be willing to pay a higher fare in the evening. There was a rather large difference between associations in this case, with many more Assoc A respondents suggesting a higher fare would be acceptable. This may be because Assoc A has the lowest fare by ZAR 1 across most, if not all, feeder associations in the area.

Figure 25. Percent of respondents agreeing with the statement.

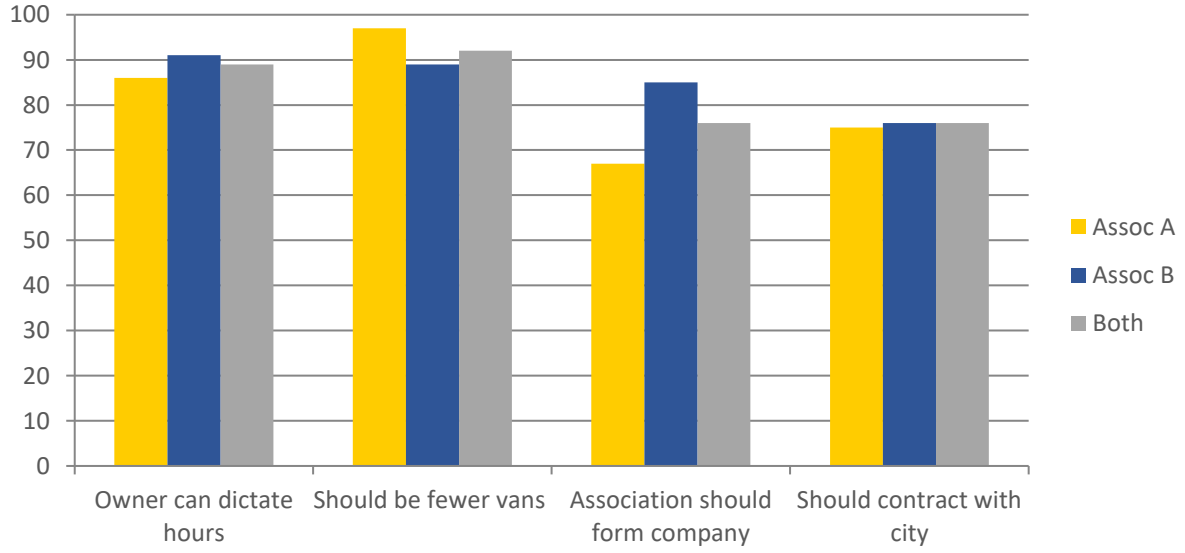


Some questions related directly to changes to the association structure (Figure 26). Despite not being formally employed by owners, drivers seemed surprisingly amenable to owners dictating their hours of work, with 89 percent overall agreeing to such a change, though one driver from Assoc A made it clear that as long as the target system remained in place, his/her owner would not be allowed to dictate hours. A similarly large proportion (92 percent) agreed that there should be fewer vans within the associations. This speaks directly to the structure of associations as loosely affiliated independent businesses that compete with each other; the more vehicles and drivers competing for passengers, the less money each individual driver will earn in a day. It is clear that respondents across both associations feel similarly that there is an oversupply of vehicles and/or an undersupply of passengers. One way to address this issue is to reduce the number of vehicles and drivers so that each remaining

driver receives more trips in a day and therefore earns more. Obviously this works well for those that remain, but there is little incentive for others to exit the system, especially when 96 percent of respondents stated that driving is their sole source of income (Figure 27). Another way to address this issue is by collectivizing fleet management and scheduling drivers on shifts. As demonstrated by the TOC pilot undertaken by the City with Assoc B, this scheduled service requires fewer vehicles than currently exist in the association, but still employs the same number of drivers. While this may not work in every situation, all scheduled bus operations employ more than one driver per vehicle to ensure reliable service is provided if drivers call in sick and to comply with government working hour restrictions, etc.

Differences between the associations appear regarding company formation, with only 67 percent of Assoc A amenable to this change compared to 85 percent of Assoc B respondents. Overall, this is still a relatively acceptable change independent of the other conditions necessary for a shift to corporatization. One reason the Assoc B proportion may be higher is because Assoc B already conducts some business as a collective; fueling and maintenance is completed at their facility which allows cost savings from bulk fuel discounts. Contracting is similarly favorable across all respondents and consistent between associations. Contracting may be seen as a way to obtain employment that brings a salary and benefits, both of which are highly desired (Figure 27).

Figure 26. Changes to the association structure: percent of respondents agreeing with the statement.



In late 2017, median daily profit across both associations was ZAR 225 earned over five trips. For Assoc A, median profit was ZAR 200 earned over three and a half trips while at Assoc B, respondents earned ZAR 255 over five and a half trips. The money earned by drivers and owner-drivers in these two associations is critically important as 96 percent have no other source of income (Figure 27).

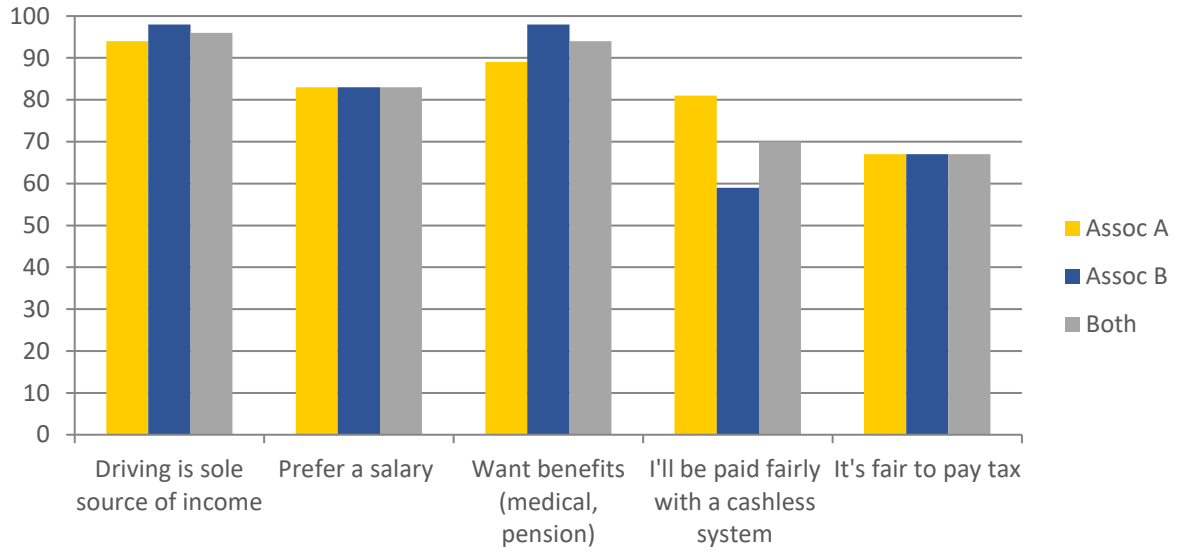
Respondents clearly prefer to be paid a salary, which would provide a more stable income compared to the target or commission system that links earnings directly to the number of passengers carried in a day. This is subject to many external factors, including trunk PT reliability, weather, time of the month (with increased demand around SASSA and salary payment times), and the number of drivers operating per day. Respondents were allowed to comment on this question, and the most common responses from Assoc A were that a salary would be less variable and a salary was seen as a better fixed amount. Among Assoc B, the most common responses were that drivers are unable to budget with money earned on a daily basis, and that a salary would allow them to work fewer hours. Former MBT operators now operating under contract with the Bombela Operating Company (Gautrain operator) in Gauteng Province reportedly are happy under the contracting arrangement partly because they work fewer hours (Semake & Nortje, 2018). Most respondents prefer to be paid weekly (76 percent), though this is higher at Assoc B (83 percent) than at Assoc A (69 percent). An even higher proportion of drivers (94 percent overall) want medical and pension benefits.

Typically, paratransit drivers are assumed to be resistant to CFC systems because it reduces their control over the money coming into the business. With cash fares, drivers collect this money and either pay the target and keep the remainder for themselves, or report the gross revenue and split the money with the owner on a percentage basis. In the case of the target system, owners are unable to know exactly how much money is being earned because they only see the agreed-upon target amount. Under a commission system, drivers are supposed to report all revenue to owners, but in reality some underreport to avoid having to split it with the owner. In both cases, CFC eliminates the information asymmetry between the parties to the driver's disadvantage. However, 70 percent of respondents felt they would be paid fairly even with CFC implemented, a surprisingly high proportion considering the implications (Figure 27). The lower proportion among Assoc B respondents (59 percent) may be explained by the commission system; it is possible that because drivers know that 70 percent of the earnings are going to the owner, they feel a sense of injustice. Indeed, a few Assoc B drivers commented during the survey that they underreport because they are not getting a fair deal with the current split. While CFC does not guarantee that drivers will move to a salary, it may begin a conversation about fair remuneration. Again, this question provided an opportunity for respondents to comment. The most common response across both associations was that CFC is safer than cash by making the van a less attractive target for robberies.

It is also assumed that many in the industry are resistant to paying tax on earnings. As cash-based businesses, the obligation is on the individuals involved to report earnings on tax filings, but this can

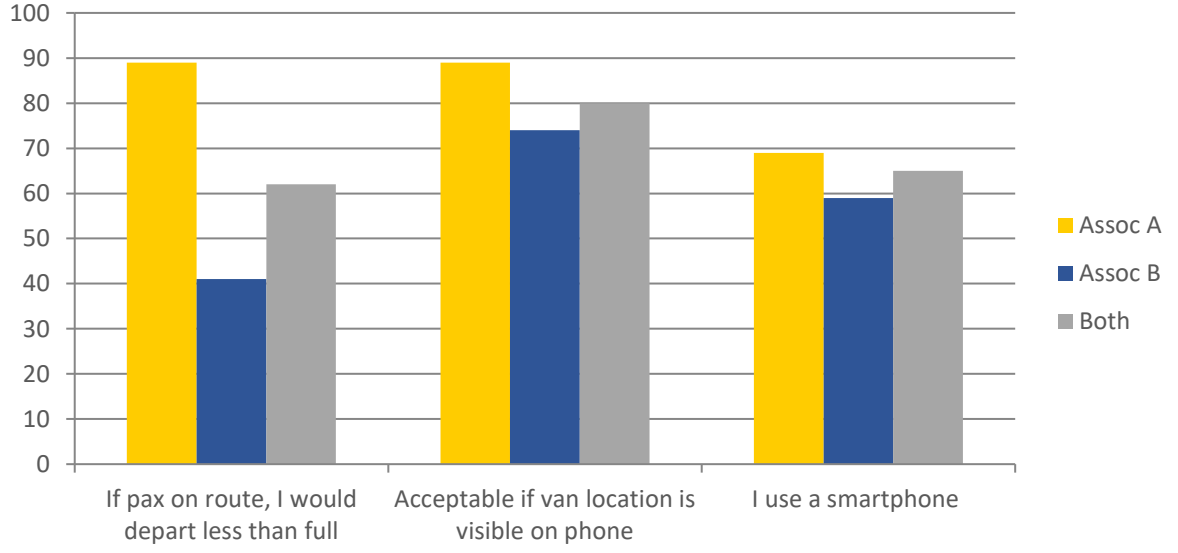
easily be underreported with no paper trail. Again, results are surprising; 67 percent of respondents felt it was fair to pay tax on income (Figure 27).

Figure 27. Driver remuneration: percent of respondents agreeing with the statement.



Some have promoted the idea of e-hailing as a potential mechanism to address the shortcomings of paratransit. In fact, the Integrated Public Transport Network Business Plan adopted in 2017 by the City labels such a solution a "new generation service" enabled by emerging smartphone technology. The plan suggests this mechanism can provide more direct routing for passengers, provide a new way for supply and demand to be matched, and reduce waiting time related to the fill-and-go mode of operation. In light of this potential push by the city, questions around e-hailing for MBTs were included in the survey (Figure 28).

Figure 28. E-hailing: percent of respondents agreeing with the statement.



The first question asked drivers if they would depart the rank with less than a full van if they knew passengers were waiting along the route. Drivers typically leave only when the van is full to guarantee the highest possible earnings before incurring cost in fuel usage during driving. However, this can lead to long passenger waiting times in off peak periods as vehicles do not fill quickly. If an e-hailing technology could enable a driver to see, via a smartphone app, that enough passengers were waiting on the route to make up the shortfall in revenue from a van leaving less than full, it may reduce waiting time both for passengers at the rank and along the route. This is especially important in the evening in Mitchells Plain where crime is an issue. Overall, over 60 percent of respondents agreed that seeing passengers on the route in advance would allow them to leave sooner from the rank, though twice as many Assoc A respondents agreed with the statement than Assoc B respondents. This is likely due to the monitoring that association leadership does at Assoc B; in an attempt by owners to quantify business revenue, all vehicles that depart the rank are stopped and must deposit a slip of paper with an association representative. All departures are recorded and then compared to money turned in by drivers at the end of the day. This system may encourage Assoc B drivers to ensure a full van because the association will expect revenue from a full van's worth of passengers even if the van is not full upon departure. Some drivers reported taking trips before the monitor is present to earn revenue without having to report it.

The second question related to e-hailing asked if drivers would accept passengers seeing their van's location in real-time via the smartphone app. This is a standard feature of Uber, Bolt, and other similar apps to provide passenger information. However, in an area where crime is a major issue, it was posited that having van locations visible to anyone with a smartphone and app could be problematic if members of organized crime saw an opportunity to target vehicles for robbery via the app. However, the large majority of respondents agreed that this capability would be acceptable and apparently did not see this as a major problem. Only a few Assoc A respondents suggested it could be a security risk.

This mechanism relies on smartphone usage among drivers and passengers. While detailed information on passengers were outside the scope of this research, a question sought to determine the proportion of drivers that currently used smartphones. Among Assoc A respondents, 69 percent do while only 59 percent of Assoc B drivers do. While this is a relatively high proportion, other issues such as technical literacy in app usage and cost of data present challenges. Together, this suggests that a solution based on smartphone technology may not be the most feasible, though the government could endeavor to provide smartphones to drivers, train them on usage, and subsidize data expenditures.

In the focus group held with drivers and owners prior to the survey, safety and security was a major issue. Participants almost unanimously agreed that an armed SAPS officer would be an important addition to the rank in the evening. In light of these responses, the survey sought to corroborate by asking respondents how many times they had been robbed in the last year as part of their work in the MBT industry. Results suggest that crime is an issue; the average number of times respondents have been robbed in the past year is 0.58, or roughly once every two years. Assoc A respondents report an average of 1.23 times per year while Assoc B respondents report an average of 0.043. Anecdotally, some drivers at Assoc A suggested that Assoc B drivers have pulled together to protect each other from this sort of activity in a way that Assoc A drivers have not. Whether this is a major factor behind the difference in results is unknown. A few drivers also perceived CFC as a way to reduce robbery incidents by removing the large cash attraction. At least one driver suggested that short headways in the evening, normally seen as a cost to drivers because it reduces revenue from unfilled seats, may ensure greater safety by reducing time spent waiting at the rank.

6.4 Summary

While the discrete choice model was intended to be used to determine the probability of drivers agreeing to provide service under various scenarios, only a limited number of parameters were significant; this limited conclusions based on the model to only the profit and security attributes. Therefore, the additional non-choice task survey questions were used to determine the acceptability of the interventions and their conditions by linking particular questions to the interventions. Each intervention has its own set of necessary elements as described in chapter 5 (*Interventions*); questions in the survey such as, “Is it fair for you to pay tax on your income?” are therefore indications of how acceptable drivers find particular pieces of an intervention. For an overall intervention to be considered acceptable to a driver, that driver must find each condition acceptable.

Table 18 shows the survey questions that were linked to each intervention based on those conditions. For example, Headway bonus requires vehicle tracking devices to be installed on vehicles to allow the City to easily determine whether subsequent trips have been made within the specified headway of 30 minutes and drivers must be willing to pay tax on the incentive payment from the city. Therefore, the overall acceptability of the Headway bonus intervention is the combined proportion of drivers agreeing to these conditions (i.e., answering yes to the survey questions).

The two questions most often linked to interventions are willingness to pay tax and willingness to use a tracking device even if the City could access the data. Only the Rank security and Higher evening fare interventions do not involve these conditions because they involve minimal change to the

operating environment. Paying income tax relates in some interventions to incentive payments only, while in others includes fare revenue as well (again, more detail is in chapter 5 *Interventions*). E-hailing and Off peak contract interventions involve a number of unique conditions because each requires major shifts from the current operating environment. Because no survey question directly asked about police officer presence at the rank, the Rank security acceptability was determined from driver responses to an open-ended question requesting them to identify what is most important to passengers; a large proportion responded with some variation on safety and these proportions are indicative of drivers willing to accept a police officer at the rank.

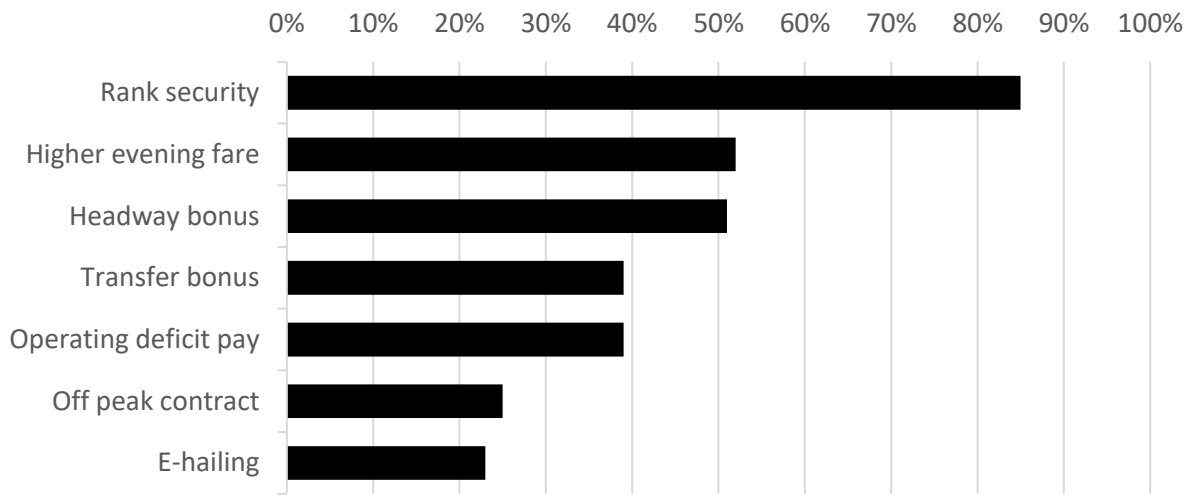
Table 18. Survey questions used to determine acceptability of each intervention.

Intervention	Prefer salary	Fair to pay tax	Paid fairly with CFC	Owner can dictate hours	Depart less than full if pax on route	Ok if location shown on phone	Use a smartphone	Tracking device	Form a company	Contract with city	Pax willing to pay higher fare	Safety is most important to pax
Rank security												X
Transfer bonus		X	X					X				
Headway bonus		X						X				
Operating deficit payment		X	X					X				
E-hailing		X	X		X	X	X	X				
Off peak contract	X	X	X	X				X	X	X		
Higher evening fare											X	

The results of acceptability analysis are shown in Figure 29. Rank security stands out as most acceptable to drivers, which aligns with findings from the focus group used to design the survey and from unstructured discussions. This intervention only requires funding for an officer's time. Two other interventions make it over the fifty percent mark overall: Higher evening fare and Headway bonus. The former requires no public authority intervention while Headway bonus requires funding of incentive payments and the installation of tracking devices on vehicles. Despite the fact that Higher evening fare requires no monitoring or changes from the status quo operating environment, there was concern among some respondents over passenger ability to pay increased fares in this lower income area. Overall, there appear to be tiers of acceptability with Rank security alone, Higher evening fare and Headway bonus together, then Transfer bonus and Operating deficit payment (these

figures are identical because each has the same conditions), followed by Off peak contract and E-hailing at the lower end of acceptability, likely partly because of the large number of associated conditions stemming from major changes from the current operating environment. Both Transfer bonus and Operating deficit payment interventions involve a shift to CFC, which provides some measure of increased security by making a robbery of the van less attractive to criminals but also increases the level of monitoring by the City compared to Headway bonus which requires monitoring only via a tracking device.

Figure 29. Aggregated driver intervention acceptability.



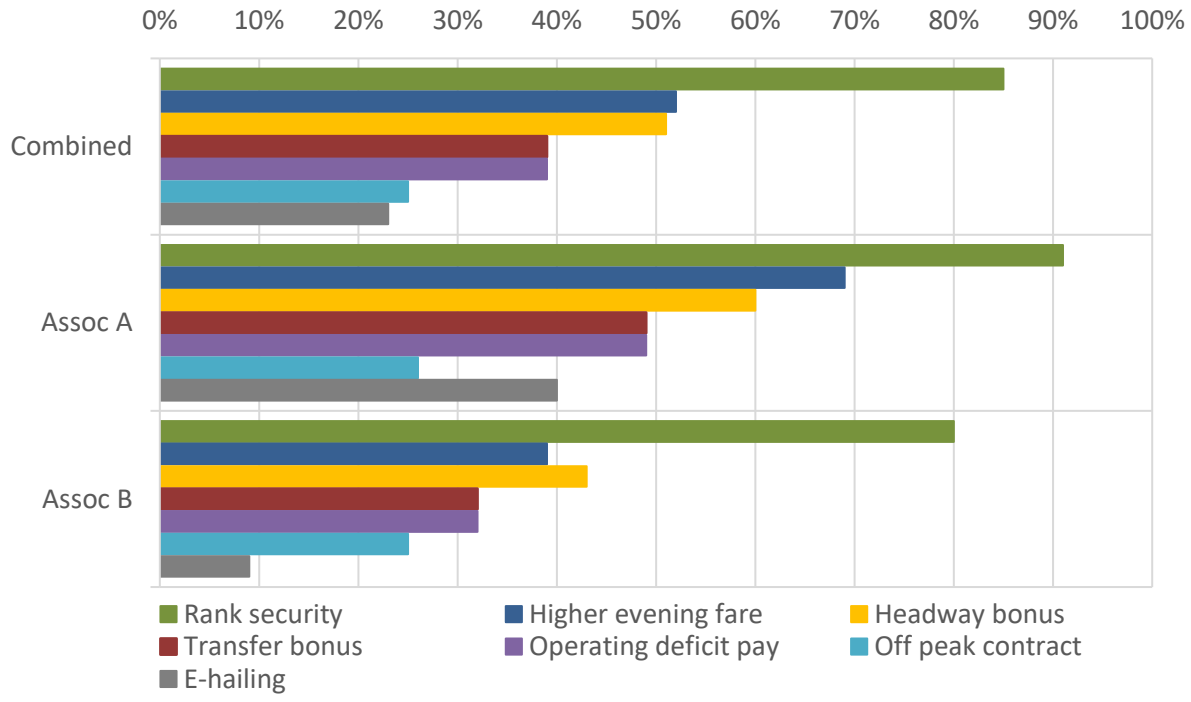
From analysis of comments made during the focus group held to assist with survey design, it seemed that providing SAPS at the rank for increased security from criminal activity might be enough of an intervention on its own to induce drivers to provide service from 7 pm to 10 pm. However, using the reduced choice model, this appears unlikely. Despite a large majority of drivers willing to have a police officer positioned at the rank, the likelihood that additional trips will be provided as a result of this intervention alone is low if it is assumed a driver would make one additional trip. With the dummy for security set to one (for the presence of a SAPS officer) and the level of profit to ZAR 18.40 (from the business model for the status quo described in chapter 8 *Implementation Feasibility*) for that additional trip, there is only a 19 percent chance of an individual agreeing to drive later under these conditions. This assumes that of the three trips expected from estimated demand, a driver would only receive one because of competition from other drivers who also felt safe enough to operate later in the evening though it might be the case that some coordination emerges where drivers agree to rotate so that a single driver provides all three trips per evening. This would increase the chance of driving to 29 percent. This probability can be determined for this intervention because of the significance of the security attribute, so is added for interest despite the variation in approach for

other interventions which is based solely on the profit attribute and the amount of profit needed for a 70 percent chance of willingness by drivers (as described above in *6.2.1 Results*).

Figure 30 shows the acceptability of interventions both in aggregate and by association. Rank security is consistently the most acceptable intervention. Higher evening fare is second most acceptable overall and by Assoc A drivers, while Assoc B drivers find Headway bonus second most acceptable. Interventions are generally less acceptable among Assoc B respondents than among Assoc A respondents.

The associations differ in acceptance of most interventions, but the largest difference occurs with E-hailing, where a spread of 35 percentage points separates the two associations. The smallest difference is with Off peak contract (one percentage point). The difference between acceptability of Headway bonus and Transfer bonus/Operating deficit payment can be contributed entirely to the addition in the latter two of a CFC system. It is clear that there is some resistance in general to paying tax, but this resistance is greater among Assoc A respondents than for those at Assoc B.

Figure 30. Intervention acceptability aggregated and by association.



Many of the conditions of interventions are necessary (such as a tracking device to prevent cheating) and therefore these cannot be adjusted or eliminated to improve acceptability. However, the payment of tax can be adjusted through an exemption. By removing the requirement that MBT drivers pay tax on earnings, government can increase the acceptability of some interventions dramatically as shown in the difference between Tax owed and Exempt columns in Table 19.

However, this exemption cannot be given by the City and would need to be coordinated with SARS. Interventions are sorted from most to least acceptable by the first column in the table. Some interventions, i.e. Higher evening fare and Rank security, do not necessitate tax obligation so these numbers are constant across both situations. For the other interventions, the largest change in aggregate acceptability is with Headway bonus, where acceptability increases 24 points to 75 percent. The smallest increase occurs with E-hailing, where acceptability increases only 8 points to 31 percent, though the exemption would apply in this case to fare revenue rather than only incentives under a Headway bonus intervention. From this data, it is clear that government could use tax exemptions as a tool to increase acceptability among the industry for various interventions, though with varying success. More is noted in chapter 9 (*Discussion*).

While it is difficult to say whether drivers will exceed the ZAR 78,150 threshold for tax obligations (as discussed in chapter 5 *Interventions*) because individual situations vary both in number of trips taken and outside income, it is very likely that drivers working as salaried employees of an operating company under the Off peak contract intervention will earn enough to be taxed. Assuming drivers make the SARPBAC rate of ZAR 47.83 per hour for eight hours over 260 weekdays in a year, gross income will be ZAR 99,486.

Table 19. Intervention acceptability aggregated and by association for two tax scenarios. When only one value is presented, tax payment is not inherent in intervention.

	Combined		**Assoc A only**		**Assoc B only**	
Intervention	**Tax owed**	**Exempt**	**Tax owed**	**Exempt**	**Tax owed**	**Exempt**
Rank security	85%		91%		80%	
Higher evening fare	52%		69%		39%	
Headway bonus	51%	75%	60%	89%	43%	64%
Transfer bonus	39%	58%	49%	71%	32%	48%
Operating deficit payment	39%	58%	49%	71%	32%	48%
Off peak contract	25%	34%	26%	37%	25%	32%
E-hailing	23%	31%	40%	54%	9%	11%

Anecdotal information was collected from respondent comments recorded during the survey as well as from surveyors who conducted surveys with drivers and owner-drivers. Some Assoc B respondents perceived a requirement to depart the rank at specified headways as a potential safety mechanism, where spending less time waiting at the rank would reduce risk. Two drivers from Assoc B suggested that police should follow vehicles along the route to ensure security beyond the rank environment. It is interesting to note that Assoc B drivers seemed to have a greater sense of comradery than those at Assoc A, with a few drivers suggesting that drivers might stay later together to ensure each other's

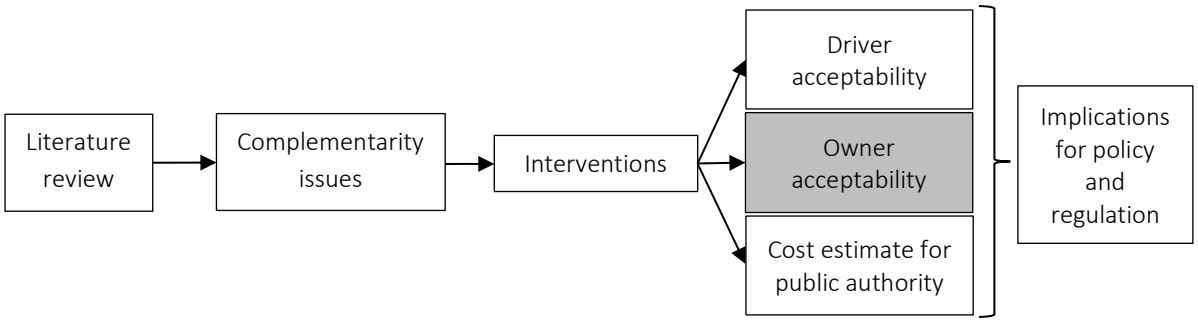
safety. This seems to align with the lower acceptability of police presence among Assoc B respondents compared to those from Assoc A. Related to the Off peak contract intervention, one Assoc A driver was concerned that benefits of a contract with the City would go to owners and the association rather than drivers, while a driver at Assoc B voiced concerns about potential job losses from forming a company.

The information presented in this chapter is critical for policymakers as they embark on future PT reform in Cape Town. Success in reform hinges on operator willingness to accept it. A quote from a blog on the Nairobi experience with CFC implementation concisely communicates the point:

> *"The most crucial piece – the driver – is overlooked in all the sketching and planning, and the opinions. In the case of Google, no one bothered to look [at] digitizing the industry from the point of view of the matatu drivers and touts who were expected to roll out the service on the ground." (Kimani, 2018)*

However, owners are also crucial to any reform. In the same manner as drivers, owners must be willing to accept interventions that change their operating environment and business. The next chapter (7 *Owners*) presents the method and results from data collection with owners from the MBT industry, while the following chapter (8 *Implementation Feasibility*) brings the two perspectives together, along with cost estimates, to recommend the most promising path for paratransit reform in Cape Town.

7 Owners



Knowing the driver perspective on interventions (chapter 5 *Interventions*) from the previous chapter (6 *Drivers*), the owner perspective must now be determined. As discussed in chapter 2 (*Literature Review*), the perspective of both groups is critical to understanding the potential for any of the interventions to be successfully implemented, and a synthesis of both perspectives is included in chapter 8 (*Implementation Feasibility*).

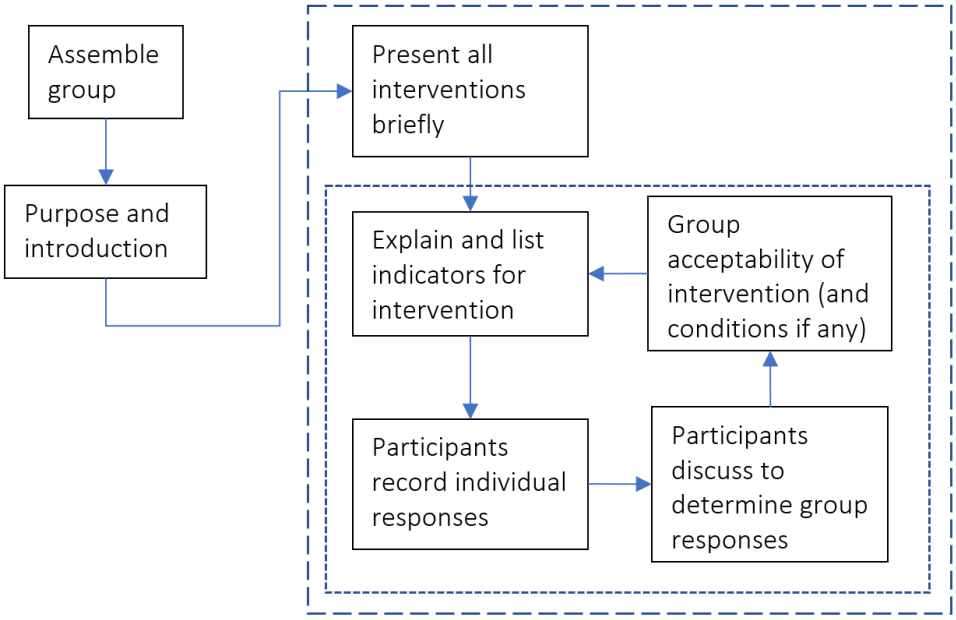
This chapter describes the method used to collect data to understand the owner perspective and the results obtained through analysis. The final section (*7.2.4 Summary*) summarizes the owner acceptability of each intervention and sets the stage for a discussion of overall feasibility in the next chapter (8 *Implementation Feasibility*).

7.1 Method

Data collection and analysis used a unique blend of both quantitative and qualitative methods; statistical tests were conducted alongside qualitative methods that allowed a deeper understanding of opinions than a purely quantitative process. Because the main goal of this research is to inform policy, qualitative methods are appropriate to use (Grosvenor, 2000). One common qualitative data collection method is a focus group which was used in the process of SC survey design, as discussed in *6.1.3 Survey design*; therefore general background on focus groups is not repeated here. However, the focus groups conducted with owners followed a more structured approach in order to collect quantitative data and as a result used a questionnaire rather than a topic guide (Hennink, 2007). A focus group is still appropriate here because my goal aligned with that of this method: to "describe and understand meaning and interpretations of a select group of people to gain an understanding of a specific issue from the perspective of the participants of the group" (Liamputtong, 2009). An added benefit of using a focus group for data collection over individual interviews and questionnaires is that group interaction highlights agreement and points of conflict to provide deeper insight into the issues (Pfeffer, 2008).

Quantitative data provided insight into the owner perspective on interventions but also subcomponents of interventions, termed indicators. For example, the Transfer bonus intervention relies on CFC to quantify passengers qualifying for bonus payments to be paid to drivers; willingness to use a CFC system therefore serves as an indicator for acceptability of the Transfer bonus intervention. Breaking interventions down in this way allows insight into why a particular intervention is or is not acceptable and may help to identify additional interventions that may be feasible by combining the most acceptable indicators. The focus group was structured around a questionnaire organized by intervention and allowed for discussion to elucidate the details behind responses. Figure 31 shows the facilitation process.

Figure 31. Focus group facilitation process.



Once the group was assembled and interventions were presented, the focus group followed a repeated pattern of my explanation of indicators, individuals responding to questionnaires, and finally a group discussion towards a group response to the same questions on the individual questionnaire. This allowed collection of both individual and group responses in parallel. The group perspective was critical to understanding how owners might react to interventions if implemented because associations have been the entity with which government has engaged in past PT reforms. The power dynamics of these bodies surely varies, suggesting that aggregating individual responses as an indication of how an association might feel about an intervention is possibly inaccurate; allowing for power dynamics to play out in a focus group allows a realistic assessment of how the group might decide on any particular intervention. In some cases, a strongman might essentially dictate choices to other members while in other cases decisions might be made more democratically. Collecting both

individual and group data allowed me to test this theory and ensure that conclusions do not sidestep the issue of power dynamics and group decision-making.

The goal of focus groups is to collect a range of opinions (Krueger & Casey, 2015; Liamputtong, 2011), which was certainly a goal in this case, though the endpoint of discussion around an intervention was a set of group responses (yes or no) that indicated acceptability of the indicators and the intervention overall. I facilitated discussion to ensure all indicators were covered and led the group to decide on a response for each, indicating whether they would be willing to, for example, have a City-monitored CFC system on their vehicles. Facilitation did not attempt to reach a consensus on this decision because I did not want to interfere with group dynamics; contrary to standard focus group methods, the stronger voices were allowed to dominate (Hennink, 2007).

Liamputtong (2011) and Krueger & Casey (2015)highlight issues with focus groups, one of which is the potential for lack of honesty with groups comprised of those from a common workplace because of the potential for intimidation; however, for implementation of an intervention, this intimidation factor would be present as the association determined what to do and for this research to be valid, data collection needed to allow for this to happen. Liamputtong also suggests that focus group participants may feel pressured to conform to the majority opinion, but again this issue needed to be allowed to occur to mimic reality as close as possible. Finally, there is a concern that groups larger than eight will prevent some participants from talking; this again is a situation likely to occur in reality and therefore groups were allowed to be larger than eight individuals.

The quantitative questionnaire that structured the focus group started with informed consent and seven questions asking about the respondent:

- Number of vehicles owned
- If MBTs provided the owner's sole source of income
- If the owner had a position on the executive committee
- Number of years in the MBT industry
- Gender
- Age
- Household size

The remainder of the questionnaire was organized by intervention and filled out in stages as the intervention was discussed. Table 20 shows the indicators by intervention; note that some of the indicators are repeated across interventions because they apply to more than one. Other indicators appear only once. The questionnaire was designed based on the components of interventions as

designed (discussed in chapter 5 *Interventions*) and worded to allow for a yes or no response enabling statistical tests for categorical data described below.

Original design of the questionnaire used Likert-type responses rather than binary yes/no responses. The literature is mixed on response category format, with both Cox (1980) and Preston & Colman (2000) suggesting that design decisions are situation-dependent. Older research suggests that two and three category responses frustrate respondents (Cox, 1980), but more recent research suggests some benefits to using two point scales, such as respondent speed in responding, while also recognizing that it limits respondent expression and may be difficult to use compared to a five point scale (Preston & Colman, 2000).

To assist in understanding statistical impacts of using various response types, I engaged the help of the UCT Statistical Consulting Service who provide one-on-one consulting services to clients internal and external to UCT. Consultants suggested Likert-type responses would complicate the analysis; one solution is to collapse categories for analysis, but data is lost by doing so. The other option is to simplify responses into yes/no which consultants emphasized would not only allow for straightforward use of Chi-square and Cramer's V tests (discussed more below), but also be more straightforward for respondents to understand and respond to, echoing Preston & Colman (2000). This was a key concern as focus groups were expected to last up to two hours, testing the limits of participant fatigue. In addition, because the method relied on both qualitative and quantitative data, reduced answer granularity would not be a major concern as answers would be further illuminated by the focus group discussion captured through qualitative analysis.

Table 20. Interventions and associated indicators.

Intervention	Indicator
Rank security	I would let drivers keep all extra income.
Transfer bonus	I would allow a City-monitored cashless fare collection system on my van(s). I would allow a City-monitored tracker to be installed in my van(s). I would accept paying tax on all my income. I would let drivers keep all extra income. I would allow the driver to be paid directly.
Headway bonus	I would allow a City-monitored tracker to be installed in my van(s). I would let drivers keep all extra income. I would allow the driver to be paid directly.
Op. deficit payment	I would allow a City-monitored cashless fare collection system on my van(s). I would allow a City-monitored tracker to be installed in my van(s). I would accept paying tax on all my income. I would let drivers keep all extra income. I would allow the driver to be paid directly.

E-hailing	I would allow a City-monitored cashless fare collection system on my van(s). I would allow a City-monitored tracker to be installed in my van(s) I would accept paying tax on all my income. I would accept passengers seeing my van's location on their phones. I would accept a change from route licenses to defined area licenses. I would allow the driver to be paid directly.
Off peak contract	I would allow a City-monitored cashless fare collection system on my van(s). I would allow a City-monitored tracker to be installed in my van(s) I would accept paying tax on all my income. [Association name] should form a company. There should be fewer vans at [association name]. I would shift to a company structure that may give me less control over my business. I would trust the company to pay me what I am due.
Higher evening fare	I would let drivers keep all extra income. I would accept raising fares slightly in the evening.

7.1.1 Administration

To test the questionnaire and facilitation process, a pre-pilot was organized with City officials familiar with the MBT industry who acted as MBT owners to highlight issues and suggest improvements. The full focus group and questionnaire was not completed because the repeated nature of the structure allowed individuals to grasp the process and provide feedback after two to three rounds. Originally, facilitation included many more transitions between individuals completing portions of questionnaires and group discussion at the indicator level; in other words, each indicator was introduced, individuals marked their questionnaires, and then the group was engaged in discussion. During the pre-pilot, respondents were excited to jump into discussion, skipping the individual questionnaire portion; it became clear that minimizing the number of transitions would be key to ensure questionnaires were not left blank and individual data was not influenced by individuals who spoke up before everyone had finished. The facilitation process was then adjusted to that shown in Figure 31 where all indicators are explained together, individuals complete questionnaires for all indicators together, and finally the group discusses the indicators and intervention together. This method also led to more holistic thinking about indicators which is more realistic; for example, CFC usage is linked to tax payment because income is recorded and visible to the authorities.

Other changes included a wording adjustment to the indicator regarding tax. It originally read, "I would be willing to pay tax on my income" and was changed to read "…on all my income." This suggestion came from pre-pilot participants who suggested that some owners do report and pay taxes, though likely not on all income, and with a CFC system, owners would be forced to pay tax on all income because they would not have the ability to underreport.

For the E-hailing intervention, participants suggested making clear that the City would provide this app rather than MBT owners sourcing it from a private company and because the City had invested in the app, it was likely that data would be collected for planning purposes as a condition of use.

Broader changes included adjustments to the introduction to add a brief overview of each intervention and putting the Headway bonus and Transfer bonus interventions subsequently in the overall order.

After adjustments from the pre-pilot, a true pilot was conducted with actual MBT owners to ensure the method would be effective before engaging with the MBT associations of interest. Because relationships take a long time to build, it was important to ensure successful focus groups with associations with which I had already collected driver data and therefore looked elsewhere for pilot respondents. I engaged with a series of feeder associations operating from the Wynberg and Retreat PTIs starting in November 2018 (more on this process below) and managed to build a fairly good relationship with the chair of a Wynberg area association (Association F) that enabled a focus group to be organized on 15 January 2019. Unfortunately the association did not have meeting space of its own, so space at UCT was organized for the focus group and participants were willing to travel to participate with only a catered lunch as incentive. While using space unfamiliar to participants is not ideal (Liamputtong, 2011), UCT is a neutral space as an academic institution and participants seemed fairly comfortable and willing to share honestly; at times discussion was quite lively. In addition, UCT is considered a prestigious university and participants were sometimes overheard remarking that it was exciting to be there. Consent was obtained after explaining the purpose and use of the research; surprisingly participants were willing to be audio recorded during the discussion despite the relatively limited relationship I had with the chair compared to that with Assoc A and Assoc B and not having formerly met any of the other participants in the group. This was an important finding in and of itself, and encouraged me to use the audio recorder for Assoc A and Assoc B; both were willing and this provided me a depth of data via a full transcript that would have been impossible with notes only. The pilot also confirmed that the focus groups would not take longer than two hours, which is a key recommendation to avoid participant fatigue (Liamputtong, 2011).

Similar to the focus group used for SC survey design, I relied on the chair to select and organize participants. Unfortunately the group that arrived was a mix of associations as well as drivers and owners; as a result, much more disagreement arose from this group than would be expected in an owner-only group and some responses were given as halfway between yes and no. This meant that results could not be analyzed to confirm the intended analysis method and highlighted that I needed to be clearer about the needs and intentions of the focus groups when I engaged with associations

less familiar with me and my research (discussed further below) to ensure I obtained the right individuals.

After the pilot, focus groups were conducted with the two Mitchells Plain associations, Assoc B and Assoc A, on 12 March and 14 March respectively. Catering was organized as appreciation for spending the time participating and this allowed a chance for me to informally interact with owners afterwards, which was a nice way to end the session. Both groups were intended to be a census of all owners in the association, though neither group included a majority of owners. Assoc A organized five owners out of 31 (16 percent) while Assoc B organized 11 out of 26 (42 percent). While drivers are often waiting at the rank for their next trip and this provides an opportunity to engage them, getting owners together for a non-essential two hour meeting proved more difficult. Holding the focus groups on these dates came about only after repeated requests to my primary contacts to organize owners to attend. Similar challenges obtaining respondents were experienced by Randall (2019).

Within the Assoc A focus group, one individual was more vocal than others, though at times a second individual would become talkative as well. Others in the group were less vocal, but generally engaged while one was disengaged for a majority of the time. Assoc B participants were generally engaged, through a few were obviously less interested. One challenge with this group was that a few participants left partway through and others arrived late. There were two individuals who quickly grasped the details and implications of concepts and assisted in clarifying throughout the discussion; these two and a third were the most vocal participants with another three to four participants less vocal but still engaged throughout.

Both focus groups lasted about one hour 30 minutes. Discussion around particular indicators was lengthy the first time a repeated indicator appeared and shorter in subsequent instances. For example, Transfer bonus elicited long discussions because it involves many indicators and most appear for the first time based on the order of the focus group facilitation. However, in some cases, discussion was lengthy in later instances of an indicator such as for the tracker indicator for Headway bonus as discussed below.

Because the primary goal of this research is to determine what interventions are feasible to implement based on the level of acceptability from both key stakeholders in the MBT industry, both driver and owner data was collected from Assoc A and Assoc B. However, it is also important to consider whether these two associations are similar or different from associations in other areas that are also operating similar feeder services. To that end, additional associations were engaged in the hope that members would be willing to participate in a focus group which would allow comparable

data to be collected and provide some insight into whether, because of previous engagement through a capacity-building program and the TOC pilot (chapter 3 *Research Context*), the Mitchells Plain associations might be unique in their perspective. A similar concern was highlighted by Schalekamp (2015) related to BRT implementation in Phase 1, with the goal of interviewing operators from outside the Phase 1 area to consider variation in associations.

I began a process of identifying eligible associations to approach, starting with identifying PTIs with considerable MBT feeder services; according to a cluster analysis of route data these include the CBD, Bellville, Mitchells Plain, Retreat, and Wynberg (Du Preez et al., 2019). Upon advice from other UCT researchers with experience in the MBT space, I excluded associations within the CBD because of past involvement with implementation of MyCiTi services and excluded associations affiliated with the mother bodies CATA and CODETA because of tensions between these groups. Despite this advice, I did contact the head of CODETA on 10 October 2018 to ask if any associations might be willing to participate; the response was an unequivocal no. With advice confirmed by this experience, I proceeded to investigate associations outside of these mother bodies.

Four areas remained, though Mitchells Plain associations were already included so no additional associations were recruited here. Unfortunately the Bellville rank was closed following a shooting in September 2018 and I deemed it risky to conduct research here with no previous contacts or understanding of the area and associations (Evans, 2018). The remaining areas for recruitment then were Retreat and Wynberg. Because Phase 2A of MyCiTi implementation will include both Mitchells Plain and Wynberg, including associations from Wynberg may provide information that City officials can use during the planning process.

Particular associations were selected through a combination of approaches including visual inspection and querying of City GIS MBT routes and conversations with TDA officials familiar with associations and routes operated. Through these conversations I was able to refine my initial list of associations to approach by excluding those with long average route distances which would indicate that services were not feeder in nature. The basis for determining which route distances were likely feeders were based on the categories used in the cluster analysis by Du Preez et al. (2019) where feeder routes had distances of less than 10 kilometers. After this refinement process, six associations were shortlisted. Table 21 lists these associations and their status in this research.

Table 21. Associations approached and included in focus group data collection.

PTI	Association	Data collection status	Data collection date
Retreat	Association C	Individual interview	15 May 2019
	Association G	Individual interview	8 May 2019
Wynberg	Association D	Individual interview	23 May 2019
	Association E	Individual interview	30 May 2019
	Association F	Included as pilot	15 January 2019
	Association H	Not included	

I approached drivers from Association H at the Wynberg PTI on 26 November 2018, but received little interest or assistance. Repeated contact to an email address and phone number posted in association vehicles did not produce results and I later learned that this association is affiliated with CATA and therefore decided to exclude it. I was more successful engaging with the other associations from the ground up using a similar approach of visiting PTI ranks and asking around until I found drivers or owner-drivers from the association of interest. Avoiding contact through City officials was key (Schalekamp, 2015). From there I would ask for a phone number for the chair which often required going through a few different people before it was found. In some cases, I was successful in meeting with the chair in person the same day. This approach proved to be effective, though time-consuming; rank visits were typically many hours each because I talked to a number of people and if I had set up meetings with a chair, I often had to wait. It was also useful to talk with drivers to get a sense of routes, demand, and other characteristics of the association and MBT services provided.

I made an initial visit to Wynberg PTI on 26 November 2018 and was able to meet with the chair of Assoc D by nature of his status as an owner-driver which means he is more likely to be at the rank on any given day compared to an owner. I asked around and was told to wait as he was out on a trip; upon his return we spoke in his vehicle about the association and services they provide. He agreed to discuss the idea of a focus group with the executive and get back to me. On the same day, I was able to collect phone numbers for chairs of Association E and F and visited the Retreat PTI. In Retreat, I talked to an owner-driver from Association G and though I was unable to find a phone number for Assoc C, a driver suggested I return earlier another day and I would likely find executives in the office at the PTI.

I returned two days later to meet with the chair of Association F and was able to collect detailed information about MBT service span, passenger demand, and a tentative agreement to participate in a focus group. Receiving such a positive response after only the first meeting was unusual and welcome. I also visited Retreat and was happy to find a number of executives and others at the Assoc

C offices and gained some understanding of their services and learned that Assoc G vehicles load on the opposite side of the railway line; I decided to return again for first contact with them.

On 30 November, I visited Retreat and met the chair of Assoc C who quickly delegated any engagement with me to the vice chair who was happy to discuss basics about the association's services. We talked about the potential for a focus group which would require hosting at UCT because the association does not have office space large enough; the vice chair agreed to discuss with the executive and return with an answer. After concluding this meeting, I went across the tracks to the small parking area on the other side of the PTI where Assoc G vehicles load. I had received the chair's name and phone number from the Assoc C vice chair. A driver from Assoc G loading at the PTI agreed to show me where the chair lived as it was along the route; he stopped in front for me and suggested I knock on the door. An unannounced arrival from a stranger was received in a rather lukewarm way, but we made a vague agreement to meet at another time in the future.

Over the next couple weeks, I contacted those I had met via WhatsApp or additional visits to the ranks to attempt to build rapport that would eventually lead to a focus group with each association. However, as the holiday season was approaching, many owners were reluctant to schedule anything and suggested we revisit the idea in mid-January. The chair of Association F was fortunately willing to organize participants for a pilot focus group which was held on 15 January, as discussed above. Others seemed to be less interested or just busy managing their business and I spent the next few months calling, messaging, and visiting ranks to continue to build rapport and hopefully gain an agreement for a focus group.

During one conversation with the vice chair of Assoc C, he offered to do a one-on-one interview with me rather than organize a focus group, suggesting that getting the owners together would be difficult. Organizing owners for association meetings was already somewhat problematic so an additional and, from their perspective, less important meeting would be more so. Towards the end of April, it became clear that the hoped for focus groups were unlikely to materialize among any of the associations so I adjusted my expectations accordingly (in a similar fashion as Schalekamp (2015)). To ensure that I could collect at least some information from associations outside Mitchells Plain, I contacted each point of contact to request an individual interview. All were willing and I was able to conduct four interviews over the month of May. Following these interviews, I attempted to gain more individual interviews through those who had already been interviewed (the snowball method) but this did not yield any additional respondents. I also contacted a few whose numbers I had from earlier efforts, but again with no success.

This challenge in organizing focus groups with associations where I had no previous relationship or trust speaks to the primary challenge of conducting research with the MBT industry, as discussed in chapter 3 (*Research Context*) and chapter 4 (*Method*). The established working relationship with the associations in Mitchells Plain made organizing a focus group a relatively straightforward affair, a marked difference from the additional four associations in Retreat and Wynberg (though Association F was an exception) and echoes the work by Schalekamp (2015) who states that "the greatest challenge was access." Van Aardt (2018) engaged MBT associations in research with data collection in the form of a 15 minute questionnaire; even with such a limited request, she faced difficulty obtaining respondents. Likewise, Randall (2019) experienced low response rates with 30 minute engagement. This research requested much more from participants in the form of a two hour focus group and even more from those I hoped would organize the participants on my behalf. In addition, previous work with the MBT industry in Cape Town found that associations act as gatekeepers to individual operators which aligned with my inability to obtain a focus group and also to obtain additional individual interviews (Schalekamp, 2015). From this and my own experience, it seems individual interviews were a reasonable compromise. Even with a much smaller sampling frame (feeder associations v. all associations), I was able to obtain 19 total owner respondents compared to the 38 obtained by Schalekamp (2015). To some degree, the inability for a chair to organize a focus group with members of the association speaks to the association format which, while varying by association, is often a loose affiliation of independent business owners who have some common and some diverging interests.

Individual interviews varied in length from 30 minutes to one hour 30 minutes. Assoc D and Assoc G interviews were somewhat rushed, and Assoc G data was not used because I was unable to explain the interventions and indicators to the degree necessary to confidently say that the interviewee considered the issues at hand when responding to the questionnaire. Interviews with Assoc C and Assoc E were longer and both individuals appeared happy to speak with me. An earlier discussion with the chair of Assoc E had given me the impression that he was uninterested in participating, but a later follow-up proved otherwise and I spent most of a day with him interviewing, riding along as he completed his route, and discussing. Two interviews were conducted inside vans (Assoc D and Assoc E) while the third was conducted in the association office (Assoc C). I took notes throughout rather than use an audio recorder because there was less information to note compared to a focus group with multiple participants and because I had less trust built with these individuals compared to those in Mitchells Plain.

7.1.2 Analysis

Both qualitative and quantitative data was collected through focus groups and interviews. Analysis of qualitative data, in the form of transcripts and notes, is discussed first, followed by analysis of quantitative data collected via the questionnaire.

Focus groups were recorded so the first step in analysis was to transcribe the recording. Aligned with best practices (Grosvenor, 2000), as the facilitator, I also completed all analysis steps. From a first listen of the recording, I noted first impressions and timestamps for when discussion of each intervention began in a separate memo document. Through additional rounds of listening, I transcribed the audio into a complete transcript with timestamps and notations for cross-talk (when multiple people are talking at once and audio is incomprehensible), words added for clarity in [], and my comments when necessary in {} to aid in understanding. Once I had a final transcript, I listened to the audio one last time to add in tone and other details. I then read the transcript multiple times while noting any thoughts that came to mind as well as potential codes to use during the coding process.

Analytic coding followed the process described by Miles, Huberman & Saldana (2014) where codes, or labels, are assigned to portions of the transcript to identify meaning. These first level, or initial, codes are revised iteratively; if a code is used often, this indicates more meaning may be derived from breaking it into separate codes. Initial codes can be descriptive (noun), in vivo (using a respondent's own words), process (gerund to describe actions), values, or others. Once initial coding is complete, codes are grouped into categories and given second level, or inferential, codes that move away from simple description towards inference to identify patterns and begin to interpret the data in higher level ways. Inferential codes should help elucidate causes, relationships, theoretical constructs, and categories or themes. Parts of the transcript can be labelled with multiple codes when appropriate. Analytic memoing, where the analyst notes codes, patterns, or other ideas, occurs concurrently throughout the coding process and assists in iterative revision of codes and later to help draw conclusions. The goal of this process is to reduce the data without significant loss of information; to that end, much of the transcript is actually not tagged with a code because an individual repeated themselves or the way of speaking was wordy compared to a written text. The end result of coding is a clear linkage, via two levels of coding, from an individual's actual spoken words to a pattern or theme. This pathway and the inferential code in particular allow conclusions to be drawn about the focus group participants' perspective.

I coded my transcripts using Word's Comment tool, highlighting the portion of text and entering the code in the comment. In the document where I noted memos, I also kept a list of codes and

definitions to ensure consistent application (Miles et al., 2014; Punch, 2005). After my first round of descriptive coding, I tallied the number of times each code was used to determine which should be split. I completed multiple rounds of this. My codes were a mix of deductive and inductive codes; deductive codes are those that arise from the data while inductive codes are those that are pre-established based on the questions asked during the interview or focus group (Miles et al., 2014). The use of inductive codes relates to content analysis where categories can be formed around an interview schedule (Priest et al., 2002). Examples of deductive codes I used included "bonus money control" and "feeling aggrieved" while inductive codes included "higher fare" and "security" which relate closely to the Higher evening fare and Rank security interventions. Once I had completed multiple rounds of coding, I reviewed uncoded portions of the transcript to ensure I had not missed any important information, then reviewed all coded portions to ensure consistent application of codes.

Further analysis was completed by using an open-source macro to extract transcript text and related code(s) from Word; the macro creates a new file in Word with a table listing page and line number, transcript text, and associated code (Fredborg, 2013). Copying the file into Excel allows easy sorting by code and enables inferential coding to group items by pattern and theme. Again, inferential codes were revised iteratively. From this second level of coding, I drew conclusions in the final column of the spreadsheet and revisited memos to see if anything from the memos highlighted additional information to add. After quantitative analysis, I used these conclusions to add context to responses received on the questionnaires.

While I did not record interviews with individuals from associations outside of Mitchells Plain, I used the same process of coding and drawing conclusions after I had typed my notes. This process of spreadsheet analysis, particularly on notes taken during interviews, is similar to that used in previous research with those in the MBT industry related to perspectives on reform (Schalekamp, 2015).

Quantitative data from questionnaires was initially captured in Excel with statistical tests completed in SPSS. Both group and individual data was collected regarding acceptance of interventions overall as well as indicators within each intervention. Much of the data is compared using tables with added colors to clearly show patterns (*7.2 Results*); all associations are compared both at the group and individual level, where individual perspectives on acceptability are the aggregated percentage of individuals. Assoc A and Assoc B are compared as the two key associations in Mitchells Plain where owner data is eventually combined with driver data to provide a holistic perspective on reform from the MBT industry perspective. Data from these two associations are also aggregated and compared to

associations from other areas to indicate the extent to which Mitchells Plain associations may be unique.

Respondent characteristics were summarized using the Descriptives command in SPSS and two-sample T-tests were used to compare respondent characteristics for continuous variables such as number of vehicles owned and owner age. Levene's test was first used to determine whether samples had equal variances and the appropriate T-test values were then used (Levene, 1960). For categorical variables, the N-1 Chi-square and Cramer's V were used.

The statistical tests conducted to compare groups included Chi-square and Cramer's V; the former indicates whether two variables are independent while the latter indicates the effect size (Cramér, 1946; Fisher, 1992). The null hypothesis of a Chi-square test is that the two variables are independent of each other; a significant test indicates non-independence. A Cramer's V test, if significant, then indicates the effect size of this non-independence on a scale of zero to one, where one is equivalent to perfect association (Cramér, 1946). Because of a relatively small overall sample size and the use of 2x2 tables (df=1), the N-1 Chi-square test was used (SPSS output refers to this as Linear-by-Linear Association) which is appropriate because all cells had expected values of at least one (Campbell, 2007). These tests were completed using the Crosstabs command in SPSS.

7.2 Results

This section presents results obtained through the analysis described above. It begins by describing respondent characteristics overall and within various groups; intervention acceptability is then introduced, followed by indicator acceptability and further disaggregation. It concludes by summarizing intervention acceptability results for owners.

7.2.1 Respondent characteristics

Characteristics of owners are shown in Table 22 and Table 23. The first line includes all owners aggregated, followed by data separated by association for those in Mitchells Plain, followed by data aggregated across Mitchells Plain and compared to data aggregated for owners from associations in other areas. Assoc A owners have more vehicles than the average owner, which contributed to a higher value for Mitchells Plain as well. Owners in other associations had relatively few vehicles per person. All owners have been in the MBT industry for a considerable number of years, with those outside Mitchells Plain the longest at almost 30 years and Assoc A the shortest at 17 years. All owners were similar in age and had similar household sizes across all groups with the exception of non-Mitchells Plain associations at an average of 7.33 persons per household

For categorical data (Table 23), all owners relied on the MBT business as their sole source of income (one Assoc B respondent left this question blank). This is higher than a larger survey of owners in Pietermaritzburg that found 62 percent of owners relied on the business for their sole income (Magubane & Manicom, 2003). Assoc B had the lowest proportion of executive members within the respondent group while Assoc A had the highest. Non-Mitchells Plain associations were represented by single individuals and each one was a member of the executive committee in their respective associations. All owners were male except one from Assoc B.

Table 22. Comparison of respondent characteristics by group: continuous data.

	Vehicle count		Years in industry		Age		Household count	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
All responses	3.79	3.54	22.41	7.63	49.21	10.42	5.53	2.86
Assoc A	5.20	5.63	17.40	3.72	47.80	6.94	4.60	0.55
Assoc B	3.45	2.73	23.11	8.74	50.09	13.17	5.45	3.45
Mitchells Plain	4.00	3.76	21.07	7.70	49.37	11.39	5.19	2.86
Others	2.67	2.08	28.67	3.06	48.33	1.53	7.33	2.52

Table 23. Comparison of respondent characteristics by group: categorical data.

	MBT is sole income	**Member of executive**	**Male**
All responses	94.7%	63.2%	94.7%
Assoc A	100%	80.0%	100%
Assoc B	90.9%	45.5%	90.9%
Mitchells Plain	93.8%	56.3%	93.3%
Others	100%	100%	100%

Chi-square and Cramer's V tests were conducted to determine if owner characteristics differed across groups, comparing Assoc A to Assoc B (as Mitchells Plain associations) and Mitchells Plain associations to all others (Table 24). None of these tests are significant, indicating that there are no statistically significant differences between respondents in each of the groupings.

Table 24. Statistical comparison of respondent characteristics by group.

	Assoc A v. Assoc B				MP v. Others			
	N-1 Chi square	**p-value[1]**	**Cramer's V**	**p-value**	**N-1 Chi square**	**p-value[1]**	**Cramer's V**	**p-value**
Sole income	no test - 100% yes				no test - 100% yes			
Executive member	1.563	0.211	0.232	0.197	1.969	0.161	0.331	0.149
Gender	0.455	0.500	0.174	0.486	0.188	0.665	0.102	0.656
	t-value	**p-value**	**CI lower[2]**	**CI upper[2]**	**t-value**	**p-value**	**CI lower[2]**	**CI upper[2]**
Vehicle count	0.853	0.408	-2.644	6.134	0.588	0.564	-3.449	6.116
Years in industry	-1.374	0.194	-14.765	3.343	-1.645	0.121	-17.434	2.243
Age	-0.362	0.723	-15.865	11.283	0.349	0.731	-5.251	7.335
Household count	-0.541	0.597	-4.240	2.531	-1.210	0.243	-5.888	1.596

Notes:
– [1] Two-sided significance.
– [2] All are 95% confidence intervals.
– Green indicates significance at 0.05 level.

The same statistical tests were used to determine if owner characteristics were associated with responses for intervention acceptability (Error! Reference source not found., in *Appendix E: Chi-square results*). No tests were conducted for the association of sole income because all owners, except for one who left this blank, responded the same way. Likewise, all owners found Rank security and Off peak contract acceptable so no test was conducted. Only three of the 30 tests were significant: years in the MBT industry shows a large effect for Headway bonus and Higher evening fare acceptability while gender shows a large effect for E-hailing acceptability. However, the gender effect is based on a single female respondent who was unwilling to accept the E-hailing intervention despite responding yes to all related indicators. Unfortunately the qualitative data from the group discussion did not elucidate more information on these responses. Overall, it seems respondent characteristics are not significantly related to respondent feelings on interventions and indicators.

7.2.2 Intervention acceptability

As discussed above, respondents were asked within the focus group to determine whether a particular intervention was acceptable as a group at the conclusion of the discussion and after all individual responses had been recorded. Table 25 indicates how each group responded; green denotes a yes response while red indicates a no response to the question, “Would you allow the ____ reform to go ahead?” Associations outside of Mitchells Plain are not included here because data collection was possible only with individuals; data is therefore discussed below in association with Table 26.

Table 25. Group-level intervention acceptability by Mitchells Plain associations.

Intervention	Assoc A	Assoc B
Rank security		
Transfer bonus		
Headway bonus		
Op. deficit payment		
Off peak contract		
E-hailing		
Higher fare		

Notes:
– Red indicates No response, green indicates Yes response.

Rank security was embraced by both associations in Mitchells Plain, which is not surprising as security issues have been highlighted throughout the research beginning with the initial focus group held to design the SC survey. However, there was a difference in emphasis between the associations here. Assoc A respondents seemed much more concerned about security than did Assoc B; those from Assoc A reiterated that current private security personnel are ineffective and that a police officer would make a big difference both for drivers and passengers. Respondents stated security of drivers and passengers is the primary priority of the association. Assoc B respondents did not dwell on security much at all but did mention (as did Assoc A) that CFC reduces the risk of robbery.

Transfer bonus generated discussion around a number of indicators which is discussed below, but in general there was not major discussion of the intervention as a whole. An Assoc A respondent stated support if the City wants to undertake such a reform.

The two associations differed in responses for Headway bonus and Operating deficit payment, with Assoc A respondents supporting both and Assoc B respondents rejecting them. Assoc B respondents mentioned that there was no owner benefit in the Headway bonus as a reason for rejecting it.

Off peak contract was strongly supported by both associations which is not surprising considering the ongoing work around the TOC pilot which prepares the association for and subsequently tests collectively managed, scheduled service that ideally leads to a corporatized association in the medium term. Assoc A respondents suggested, “at the end of the day, it all depends on a company” meaning it was unlikely that other interventions involving incentives would ever be implemented because the City would only be willing to pay under a corporate structure and never under the current association structure. Neither group seemed concerned about turning control over to a company or that any trust issues would arise. Assoc B owners noted that the company is unlikely to be viable only in the off peak period, suggesting that if this structure were to be implemented, it should be used all day.

Both associations were willing to accept the E-hailing intervention and both were also willing to have a cash fare option remain alongside cashless payment methods within the app because the app provides a record of fares, preventing drivers from underreporting gross revenue to owners. Assoc A respondents mentioned that E-hailing provides good customer service by reducing passenger wait time and one respondent at Assoc B saw E-hailing as the future because of the need to compete with MyCiTi services that allow you to call to receive real-time arrival information.

While Assoc A respondents as a group were unwilling to accept the Higher evening fare intervention according to this data, discussion within the group highlighted some agreement that higher fares are justified; drivers must receive additional pay as after hours trips are eligible for some sort of overtime pay and owners must be able to cover additional maintenance costs. There was disagreement over raising fares with some suggesting higher after hours fares are entirely normal and others indicating fares should be left as they are. On the other hand, Assoc B is willing to accept this intervention, recognizing that passengers may be willing to pay increased fares if drivers drop them closer to home as a countermeasure to the heightened security risk at this time. Some in the group stated that it would be difficult to raise fares as many passengers are low income and "every one Rand or two Rand we put up they feel it." Overall, it seems this intervention highlights mixed feelings amongst the groups.

Aggregated individual responses align with the group response, as can be seen by a visual comparison of Table 25 and Table 26. Associations outside Mitchells Plain, represented only by single individuals, are willing to accept all interventions. All three individuals stated support for Rank security because police would have a greater impact than current private security personnel, echoing a similar sentiment as the Mitchells Plain associations. The owner from Assoc E initially understood both Transfer bonus and Operating deficit payment interventions as a subsidy that would allow profitable operations de-linked from passenger count; the Assoc D respondent understood Operating deficit payment in the same way, stating that subsidy is "good because you never lose." Regarding Off peak contract, the Assoc C respondent expressed some concern over job loss for conductors and those who wash vans at the rank and noted that the association has already formed a company of which all owners are a member. Assoc D and Assoc E respondents both consider a company a necessary prerequisite for receiving any payments from the city, echoing Assoc A; Assoc D also saw company formation as a way to be included in the coming implementation of MyCiTi.

Assoc A and Assoc B show no significant differences in responses for a majority of interventions, with significant differences only for Headway bonus, Operating deficit payment, and Higher evening fare (Table 27). Cramer's V was used to assess effect size of differences between associations, showing a

large effect size for Headway bonus, followed by Higher evening fare and Operating deficit payment (Cohen, 1988). The two associations unanimously accept Rank security and Off peak contract.

Table 26. Percent of individuals willing to accept interventions.

Intervention	Assoc A	Assoc B	Assoc C	Assoc D	Assoc E
Rank security	100%	100%	100%	100%	100%
Transfer bonus	100%	82%	100%	100%	100%
Headway bonus	80%*	0%*	100%	100%	100%
Op. deficit payment	100%*	36%*	100%	100%	100%
E-hailing	100%	82%	100%	100%	100%
Off peak contract	100%	100%	100%	100%	100%
Higher evening fare	0%*	91%*	100%	100%	100%

Notes:
– Assoc A n=5; Assoc B n=11; Assoc C, Assoc D, and Assoc E n=1 each.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Table 27. Statistical comparison of intervention acceptability for Mitchells Plain associations.

Intervention	N-1 Chi square	p-value[1]	Cramer's V	p-value
Rank security	no test - 100% yes			
Transfer bonus	0.974	0.324	0.255	0.308
Headway bonus	14.000	0.000	1.000	0.000
Op. deficit payment	4.667	0.031	0.577	0.025
E-hailing	0.974	0.324	0.255	0.308
Off peak contract	no test - 100% yes			
Higher fare	11.364	0.001	0.870	0.000

Notes:
– [1] Two-sided significance.
– Green indicates significance at 0.05 level.

To indicate whether Mitchells Plain associations are generally similar or different from associations in other locations, Assoc A and Assoc B responses were aggregated and compared to aggregated responses from others. Differences are only significant for Headway bonus, though relatively large differences in percentages are evident for Operating deficit payment and Higher evening fare.

Table 28. Percent of individuals willing to accept interventions aggregated across associations by area.

Intervention	MP	Others
Rank security	100%	100%
Transfer bonus	88%	100%
Headway bonus	25%*	100%*
Op. deficit payment	56%	100%
E-hailing	88%	100%
Off peak contract	100%	100%
Higher evening fare	63%	100%

Notes:
– MP n=16; Others n=3.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Table 29. Statistical comparison of intervention acceptability, Mitchells Plain associations v. others.

Intervention	N-1 Chi square	p-value[1]	Cramer's V	p-value
Rank security	no test - 100% yes			
Transfer bonus	0.397	0.529	0.149	0.517
Headway bonus	5.343	0.021	0.561	0.017
Op. deficit payment	1.700	0.192	0.316	0.180
E-hailing	0.397	0.529	0.149	0.517
Off peak contract	no test - 100% yes			
Higher fare	1.558	0.212	0.294	0.200

Notes:
– [1] Two-sided significance.
– Green indicates significance at 0.05 level.

7.2.3 Indicator acceptability

Each intervention has associated components such as with Headway bonus where use of a City-monitored tracking device would verify service provision to determine incentives to be paid. This section presents results regarding acceptability of these indicators in aggregate while the next section discusses indicators in relation to each intervention.

Group responses regarding these indicators are shown in Table 30 aggregated across all interventions. Those indicators repeated across interventions are listed first with cells indicating details about responses. The remainder of the table shows indicators that are applicable only to one intervention. A red cell indicates a group response of No while a green cell indicates a group response of Yes.

Table 30. Group responses to indicators by Mitchells Plain associations.

Indicator	Assoc A	Assoc B
I would let drivers keep all extra income.	x5	x5
I would allow a City-monitored cashless fare collection system on my van(s).	3 N, 1 Y (Transfer)	x4
I would accept paying tax on all my income.	x4	x4
I would allow the driver to be paid directly.	3 N, 1 Y (E-hailing)	3 N, 1 Y (Transfer)
I would allow a City-monitored tracker to be installed in my van(s).	x5	4 Y, 1 N (Headway)
I would accept passengers seeing my van's location on their phones.		
I would accept a change from route licenses to defined area licenses.		
[Association name] should form a company.		
There should be fewer vans at [association name].		
I would shift to a company structure that may give me less control over my business.		
I would trust the company to pay me what I am due.		
I would accept raising fares slightly in the evening.		

Notes:
– Numbers in cells give count of indicator repeated across multiple interventions.
– When responses varied across interventions, the intervention that differed is noted.
– Red indicates No response, green indicates Yes response.

Owners seem amenable to most of the indicators, though both Mitchells Plain associations are clearly opposed to drivers keeping all extra income earned from additional evening trips. Discussion within focus groups highlighted similar sentiments from both Assoc A and Assoc B; the major reason for not allowing drivers to keep extra income is summarized by an Assoc B owner: "the van's gonna do more trips, the driver's gonna earn a bonus, but we've gotta cover the costs" of increased maintenance. Both associations stated that money should be shared to defray these costs, with Assoc B noting it was especially important for Headway bonus that encourages more trips than other interventions. However, both associations also recognize that drivers deserve to be paid for the additional hours worked, with Assoc A specifically mentioning overtime rates. Assoc A is more accepting of drivers keeping extra income earned when there are no government incentives involved.

Both associations feel that bonus money should not be paid directly from government to drivers and instead should flow through owners; the primary reason seemed to be the feeling that owners should be in control of the business. As an Assoc A owner stated regarding drivers, “He’s working for us, he’s not working for the city.” Some respondents would accept drivers being paid directly and both associations mentioned that it would be less hassle for an owner this way, especially if payments were delayed for some reason and drivers were upset. Assoc A highlighted an interesting issue that may complicate direct payments; if an owner has multiple drivers per van, it will be difficult to determine which driver should be paid and may result in government simply paying owners and expecting them to disburse appropriately rather than wade into such a complication.

Respondents in both associations were generally accepting of tracking devices and CFC for their inherent benefits—safety and security of the driver and vehicle, verifying driver routing, asserting monetary control and preventing drivers from coming short on targets, reduced risk of robbery, improved vehicle recovery—but were resistant to the City monitoring component. Owners are generally only willing to accept City monitoring of these systems if there are incentives or subsidy payments in exchange. Additionally, they want the bare minimum monitoring required to pay these incentives; for example, Assoc A accepted the use of CFC for the Transfer bonus intervention because CFC is needed to pay the incentive linked to passenger count, but were unwilling to accept CFC for any other intervention. In discussion, both associations seemed more resistant to CFC than to trackers. This bears out in group responses for Assoc A, but less so for Assoc B where respondents were resistant to trackers for Headway bonus because the device would be used to pay incentives to drivers. In this case, resistance to driver bonuses in the absence of owner bonuses bled into resistance of the instrument used to pay these bonuses. While owners in both associations recognize the benefits of trackers and CFC for them, these benefits may not be enough to overcome the fact that drivers are receiving incentives while owners are not. Some Assoc B owners suggested they would rather forego the monetary control stemming from the CFC system if it meant driver incentives would be paid. One interesting comment from Assoc A indicated that cash will never be fully eliminated from PT in lower income areas such as Mitchells Plain and recommended a parallel system that still allows cash payment. There was also a recommendation that any CFC be more flexible than the current MyCiTi system, allowing for multiple payment types.

Tax obligations were not a major issue for either association, though both seemed more resigned rather than willing to pay tax, with an Assoc B owner stating “unfortunately…you can’t run away from taxes.” An Assoc A respondent desired recognition as a service provider, stating “we must pay tax,

nobody can get away, but…our tax bracket needs to be lower because we are running a service for government."

Two indicators relate only to the E-hailing intervention: van visibility on passenger phones and a change from route to area licensing. E-hailing platforms show vehicle locations on a map within the smartphone app which is a benefit for passengers; however, security issues in Mitchells Plain highlight the risk of criminal elements misusing the app to lure drivers into a robbery like those reported for Bolt and other services in Cape Town (Palm, 2019). Neither association seemed particularly concerned about this issue. Assoc A suggested that risk of app misuse is outweighed by the benefit for passengers being able to ride door to door and reduce walking—and associated security risk—in the evening. Respondents stated that gangsters do not need an app to intercept vans because they will just wait alongside the known route as they do currently. Regarding a shift to area licensing, the Assoc B group assumed that enforcement would be stricter once vehicles are monitored via trackers and licensed in this way. It was interesting that this concern was not highlighted among other interventions that involved trackers and that prompting owners about a change in licenses spurred this.

The next four indicators in the table relate to the Off peak contract intervention and mostly concern the shift to a corporate structure from the existing association arrangement. Most respondents recognized that the associations have too many vehicles competing for passengers. Assoc A (and Assoc E) have rotation systems so not all drivers work every day, reducing wait time between trips at the rank for those working. Both Assoc A and Assoc B respondents were willing to give up control over their business; Assoc A suggested this would be a great way to give up stress as well. Those at Assoc A also qualified this response by stating that, as shareholders, owners would have the ability to remove company officials if they do not perform well. Both associations seemed willing to trust the company, though Assoc A stated the need for transparency. Assoc B may be better described as resigned to trusting the company because it will simply not work otherwise. Assoc A summarized feelings about these indicators:

> *"Why must I still have the stress? … You take the stress. As long as my banking account goes off at the end of the day, so I don't have a problem with signing over my powers or my autonomy where it comes to uh running my business."*

The final indicator refers to the Higher evening fare intervention. Assoc A was not willing to raise fares despite a number of comments suggesting this would be an acceptable change. Some in the group did suggest leaving fares as they are for additional evening trips. Despite Assoc B respondents suggesting

higher fares would be difficult for lower income passengers, the group did indicate acceptance of this indicator while stating that passengers would likely expect door to door service in exchange.

Table 31 presents aggregated individual responses for indicators for all associations. Group and individual responses generally align for Assoc A and Assoc B so discussion here focuses on responses from associations outside Mitchells Plain; the most striking result is that these associations are accepting of almost every indicator. Importantly, respondents sometimes responded yes while indicating qualifiers to me in the interview; these qualifications provide more nuance to the seemingly high levels of acceptability demonstrated by the table.

The lack of variation in responses may also be related to the fact that there was less trust built over previous research with these three associations. As discussed above, the original intention was to hold focus groups for all associations, but this aspiration had to be revised once it became clear that convincing my contacts to organize a group was unlikely. It is possible that less consideration was put into responses as a result of this lack of trust. It is also possible that engagement of Mitchells Plain associations through the capacity building program and TOC pilot meant that individuals could more readily analyze the advantages and disadvantages of these indicators compared to those who have not been exposed to such efforts.

Table 31. Percent of individuals responding yes to indicators.

Indicator	Assoc A	Assoc B	Assoc C	Assoc D	Assoc E
I would let drivers keep all extra income.	8%	11%	100%	100%	100%
I would allow a City-monitored cashless fare collection system on my van(s).	70%	89%	100%	100%	100%
I would accept paying tax on all my income.	100%	91%	100%	100%	100%
I would allow the driver to be paid directly.	60%	25%	100%	100%	100%
I would allow a City-monitored tracker to be installed in my van(s)	100%	76%	100%	100%	100%
I would accept passengers seeing my van's location on their phones.	100%	91%	100%	0%	100%
I would accept a change from route licenses to defined area licenses.	100%	82%	100%	0%	100%
[Association name] should form a company.	100%	100%	100%	100%	100%
There should be fewer vans at [association name].	100%	100%	100%	100%	100%
I would shift to a company structure that may give me less control over my business.	100%	100%	100%	100%	100%
I would trust the company to pay me what I am due.	100%	100%	100%	100%	100%
I would accept raising fares slightly in the evening.	40%	82%	100%	100%	100%

Notes:
– Assoc A n=5; Assoc B n=11; Assoc C, Assoc D, and Assoc E n=1 each.
– Underlined values indicate variation in responses by instance/intervention. All responses are aggregated in percent calculation.
– Green = 100%, yellow = 50-99%, red < 50%.

Of the three individuals interviewed, only the individual from Assoc C is an owner; the Assoc D representative is both an owner and an owner-driver and the individual from Assoc E rents a permit and vehicle together from the vehicle owner. For Assoc E, the arrangement is somewhat similar to the setup between an owner and a driver where the driver pays a target for the right to use the van. In this case, the driver pays a permit rental fee which provides access to the vehicle which is licensed to operate. The Assoc E individual is therefore not responsible for maintenance and as a result is willing to have drivers keep all extra income. A similar sentiment is shared by the owner-driver at Assoc D who would also benefit from bonus money paid to drivers. Similar to perspectives shared by Mitchells Plain associations, he acknowledges that drivers should receive bonuses for additional work performed and is accepting as long as driver bonus money does not impact owner earnings. The normal concern over increased maintenance costs did not factor into the response at Assoc D

because the arrangement between this particular owner and drivers puts the burden of some maintenance (for smaller items like brakes, lights, etc.) on drivers. This respondent also was happy to have government pay drivers directly because it will be easier; this sentiment was shared by the respondent from Assoc C who also felt that drivers should receive bonuses for working later. For Assoc C, however, maintenance costs are an issue and the respondent indicated a need for owner support to cover increased maintenance costs and eventual vehicle replacement.

CFC was acceptable to all three individuals, though the Assoc C respondent would allow monitoring only in exchange for owner bonus payments while also recognizing that CFC brings benefits such as reduced risk of robbery and potential for improving customer service. The Assoc D respondent highlighted the potential for drivers to circumvent the system, highlighting a key challenge for implementation. Assoc E stated that government always wants "a finger in the pie" when it comes to taxation, as CFC would provide insight into revenue for taxation purposes. This individual considers taxation unavoidable, and the other two respondents indicated they already pay tax and are willing to continue doing so.

Monitoring via trackers was acceptable for the Assoc C respondent, though the same requirement for owner bonus payments applied to this device as well. The inherent benefits for trackers for this particular individual did not hold major sway because the relationship with drivers is strong enough to preclude tracker usage. The Assoc D respondent recognized the security and driver monitoring benefits of tracking devices and Assoc E again felt that monitoring was reasonable.

Regarding the indicators related to E-hailing, the issue of criminal misuse of the app was a concern, though minor for most. For the Assoc C respondent, it seemed there was resignation about an inability to prevent incidents while for the respondent from Assoc E, the benefits to passenger security of being able to wait inside while monitoring the van's location outweighs the potential risk to drivers, though it did register as a concern. The Assoc D respondent saw this app capability as risky and therefore responded no for this indicator. Changing to defined-area licenses was resisted by the respondent from Assoc D because his vans are legally registered for many routes and authorities and as a result are not limited under the current regime. The respondent from Assoc E recommended simply adding to the existing OL while the Assoc C respondent felt that a charter permit could be added instead.

The first two indicators related to Off peak contract elicited little discussion. The individuals from Assoc C and Assoc D both intended to have a management job in any company formed, which likely reduced any concerns over loss of control. The respondent from Assoc E was willing to give up control

as long as he maintains a vote as a shareholder and is making money. Both Assoc C and Assoc E respondents saw shareholding as a way to make money for less work. The Assoc C respondent specifically stated he would be happy to have some of the buyout money from BRT implementation put into shares. As discussed above, both Mitchells Plain associations have been involved with the TOC pilot and therefore may be more amenable to this intervention than other associations. However, from results in Table 31 it seems this may not necessarily be the case though care should be taken in drawing conclusions from three single individuals in associations outside of Mitchells Plain. Assoc A, Assoc D, and Assoc E respondents all stated a belief that company formation is a prerequisite for any payment from government and the Assoc D respondent sees this as a path into MyCiTi incorporation.

The final indicator relates to Higher evening fare. Two individuals (Assoc C and Assoc E) mentioned the example of the Wynberg-CBD MBT route that charges higher fares in the evening as justification for such a change on their routes. The Assoc C respondent further justified an increase because of an assumption that most trips in this period are for fun rather than work. Assoc D and Assoc E respondents both indicated passengers would be willing to pay higher fares, though the one from Assoc E had some concern about the impact on lower income passengers.

7.2.3.1 Disaggregated individual indicator acceptability

This section discusses results holistically by intervention, comparing Assoc A and Assoc B to consider points of resistance in particular interventions based on individual responses to indicators. Data is presented both in table and chart form; where indicators are three or more, radar charts are used to clearly show points of resistance and how association responses differ. Chi square and Cramer's V were again used to determine if any statistically significant differences exist between Assoc A and Assoc B at the indicator level, denoted by an asterisk in the intervention tables. The test results are shown together at the end of the section in Table 39. A comparison between Mitchells Plain associations and others is conducted in the next section, *7.2.3.2 Disaggregated individual indicator acceptability – location comparison*.

For Rank security, respondents from both Assoc A and Assoc B unanimously supported the idea of having a police officer at the rank, though it is clear that a key component of this intervention—allowing drivers to keep extra income earned from additional evening trips—is a major point of resistance (Table 32, Figure 32). Owners, as discussed above, expressed the need to share this money to cover maintenance costs incurred through these additional trips; if sharing were to occur via a higher target for Assoc A or by requiring revenue from additional trips to be split via commission for Assoc B, the incentive for drivers to provide trips would be weakened.

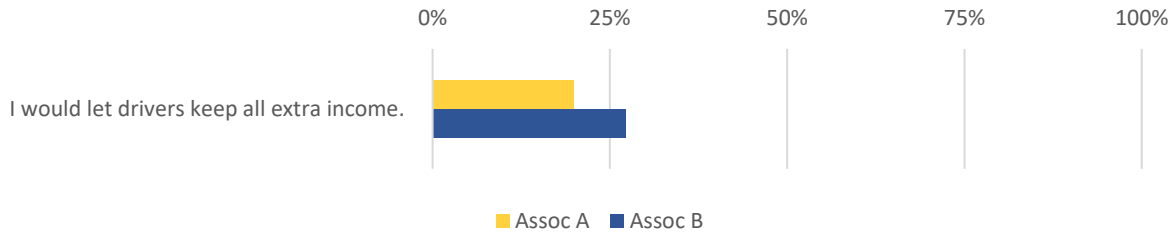
From discussion, Assoc A has a stronger desire for increased security than Assoc B does, suggesting that associations similar in many ways can still have different needs and expectations based on context.

Table 32. Individual responses for Rank security.

	Assoc A	Assoc B	Assoc C	Assoc D	Assoc E
I would let drivers keep all extra income.	20%	27%	100%	100%	100%
Aggregated individual responses	100%	100%	100%	100%	100%
Group response					

Notes:
– Assoc A n=5; Assoc B n=11; Assoc C, Assoc D, and Assoc E n=1 each.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Figure 32. Individual responses for Rank security.



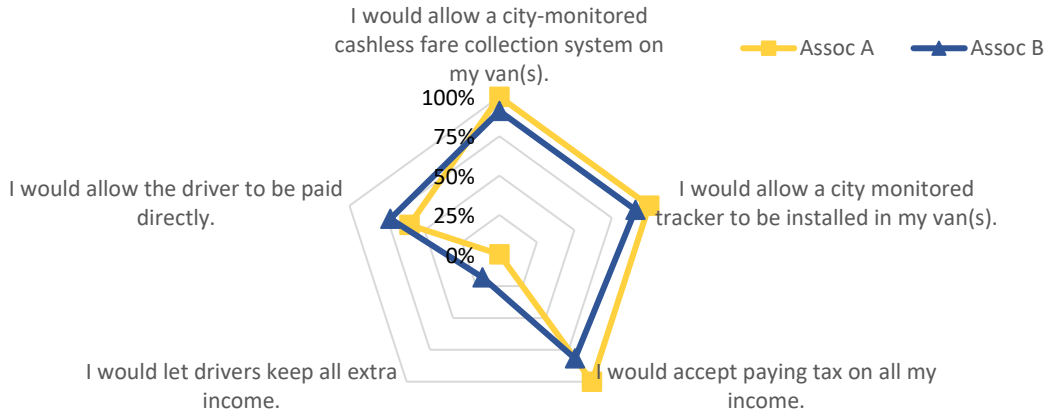
Allowing drivers to keep extra income earned on evening trips is a point of resistance for owners for Transfer bonus as well (Table 33, Figure 33). Another issue that comes up for this intervention relates to drivers being paid incentives directly by the city; some owners from both associations want to receive this amount from government and then disburse to drivers because owners feel direct payment reduces their control over the business.

Table 33. Individual responses for Transfer bonus.

	Assoc A	Assoc B	Assoc C	Assoc D	Assoc E
I would allow a City-monitored cashless fare collection system on my van(s).	100%	91%	100%	100%	100%
I would allow a City-monitored tracker to be installed in my van(s).	100%	91%	100%	100%	100%
I would accept paying tax on all my income.	100%	82%	100%	100%	100%
I would let drivers keep all extra income.	0%	18%	100%	100%	100%
I would allow the driver to be paid directly.	60%	73%	100%	100%	100%
Aggregated individual responses	100%	82%	100%	100%	100%
Group response					

Notes:
– Assoc A n=5; Assoc B n=11; Assoc C, Assoc D, and Assoc E n=1 each.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Figure 33. Individual responses for Transfer bonus.



Headway bonus demonstrates similar points of resistance as the two previous interventions (drivers keeping extra income and being paid directly), but many Assoc B respondents are also resistant to tracking devices, a shift from Transfer bonus (Table 34, Figure 34). Owners indicated that because the tracker is used in this intervention to determine the bonus for drivers, they are less willing to accept it than under Transfer bonus where it was used simply to confirm trips were taken (with bonuses determined by the CFC system). The associations differ significantly for the tracker indicator with a large Cramer's V effect size of 0.577 (p=0.025). There was particular concern over this intervention regarding maintenance costs because it explicitly encouraged the provision of more trips than other interventions; Assoc A and Assoc B respondents were both concerned about this, though Assoc B concern seemed stronger. Assoc B respondents also changed from yes responses for Transfer

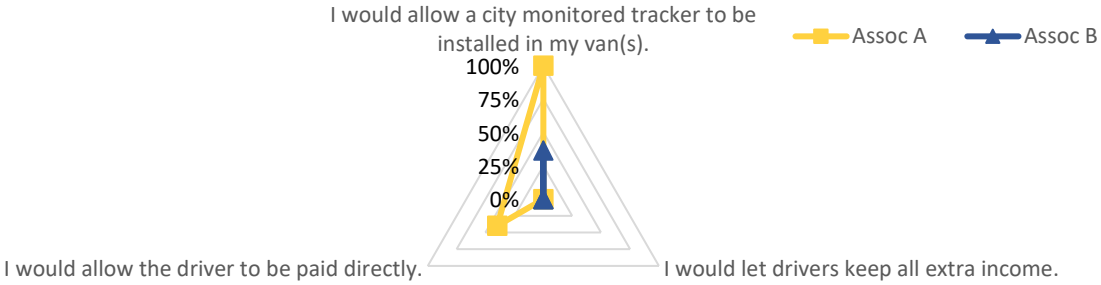
bonus/paying drivers directly to a no response for Headway bonus/paying drivers directly though discussion did not provide insight into why. The associations differ significantly for this indicator with a large Cramer's V effect size of 0.561 (p=0.025).

Table 34. Individual responses for Headway bonus.

	Assoc A	Assoc B	Assoc C	Assoc D	Assoc E
I would allow a City-monitored tracker to be installed in my van(s).	100%*	36%*	100%	100%	100%
I would let drivers keep all extra income.	0%	0%	100%	100%	100%
I would allow the driver to be paid directly.	40%*	0%*	100%	100%	100%
Aggregated individual responses	80%*	0%*	100%	100%	100%
Group response					

Notes:
– Assoc A n=5; Assoc B n=11; Assoc C, Assoc D, and Assoc E n=1 each.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Figure 34. Individual responses for Headway bonus.



Respondents were resistant to the same two indicators for Operating deficit payment, allowing drivers to keep extra income and for them to be paid directly (Table 35, Figure 35). All other indicators show relatively high levels of acceptance across both associations. Tracker acceptability rebounded from 36 percent acceptance among Assoc B for Headway bonus to 73 percent for Operating deficit payment.

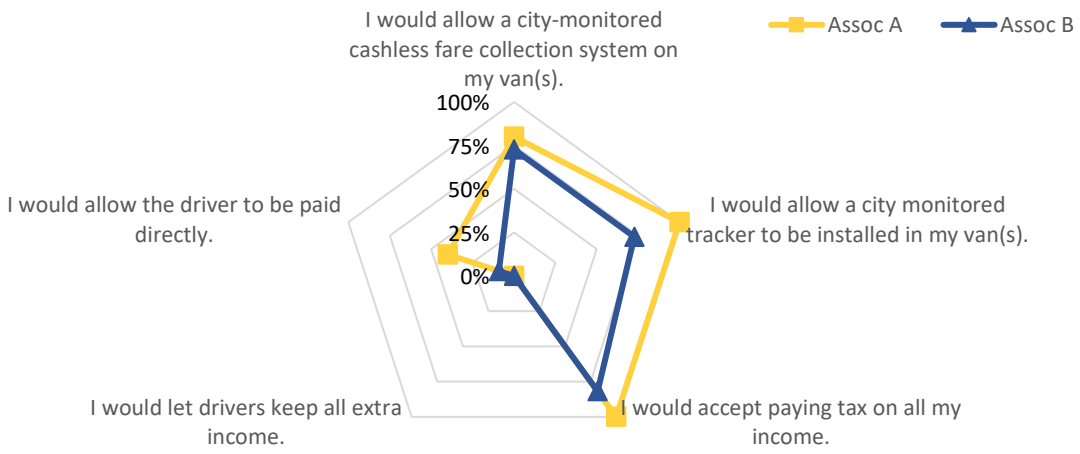
Assoc B respondents engaged in a discussion around City-monitoring and mainly agreed that in exchange for monitoring, the City must be willing to pay a subsidy. As discussed above, Assoc A and Assoc B respondents agree that only the bare minimum level of monitoring required for incentive payment administration is acceptable.

Table 35. Individual responses for Operating deficit payment.

	Assoc A	Assoc B	Assoc C	Assoc D	Assoc E
I would allow a City-monitored cashless fare collection system on my van(s).	80%	73%	100%	100%	100%
I would allow a City-monitored tracker to be installed in my van(s).	100%	73%	100%	100%	100%
I would accept paying tax on all my income.	100%	82%	100%	100%	100%
I would let drivers keep all extra income.	0%	0%	100%	100%	100%
I would allow the driver to be paid directly.	40%	9%	100%	100%	100%
Aggregated individual responses	100%*	36%*	100%	100%	100%
Group response					

Notes:
– Assoc A n=5; Assoc B n=11; Assoc C, Assoc D, and Assoc E n=1 each.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Figure 35. Individual responses for Operating deficit payment.



Minor Assoc A resistance to CFC within Off peak contract is because of the City monitoring component despite the fact that government would be subsidizing service. Some owners cited the example of GABS assuming government does not have access to fare transaction data and the company simply reports kilometers operated to receive subsidy. The owner from Assoc C expressed similar sentiments. This is an interesting perspective, and one that highlights some misunderstandings about the contractual relationship. Assoc A respondents mentioned that CFC is important for company success because it ensures needed revenue is present to support it.

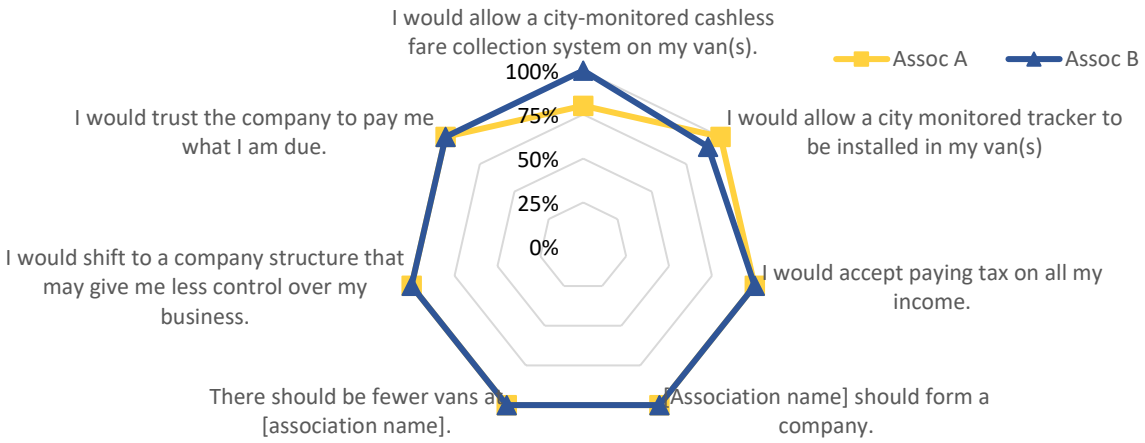
Owners who switched to a no response for this indicator for E-hailing switched back to yes for Off peak contract. The only other case where owners were not unanimously in support of all elements of Off peak contract is for Assoc B owners and tracking devices, but this was only one individual.

Table 36. Individual responses for Off peak contract.

	Assoc A	Assoc B	Assoc C	Assoc D	Assoc E
I would allow a City-monitored cashless fare collection system on my van(s).	80%	100%	100%	100%	100%
I would allow a City-monitored tracker to be installed in my van(s)	100%	91%	100%	100%	100%
I would accept paying tax on all my income.	100%	100%	100%	100%	100%
[Association name] should form a company.	100%	100%	100%	100%	100%
There should be fewer vans at [association name].	100%	100%	100%	100%	100%
I would shift to a company structure that *may* give me less control over my business.	100%	100%	100%	100%	100%
I would trust the company to pay me what I am due.	100%	100%	100%	100%	100%
Aggregated individual responses	100%	100%	100%	100%	100%
Group response					

Notes:
– Assoc A n=5; Assoc B n=11; Assoc C, Assoc D, and Assoc E n=1 each.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Figure 36. Individual responses for Off peak contract.



A common point of resistance has been allowing drivers to keep extra income, but this indicator does not apply to E-hailing as the app is intended to allow a change in operations within the existing context which includes a target or commission depending on the association. As a result, the only common point of resistance is paying drivers directly (Table 37, Figure 37). Assoc A respondents

recognized that, similar to existing e-hailing services in Cape Town (chapter 5 *Interventions*), cash fare payment would remain an option under this intervention and cash payments would need to be paid directly to drivers. Electronic payments could be paid either to owner or driver bank accounts, though it seems payment to owner accounts may be more amenable to Assoc B owners. There was a significant difference between associations for the direct payment indicator with a large Cramer's V effect size of 0.764 (p=0.002).

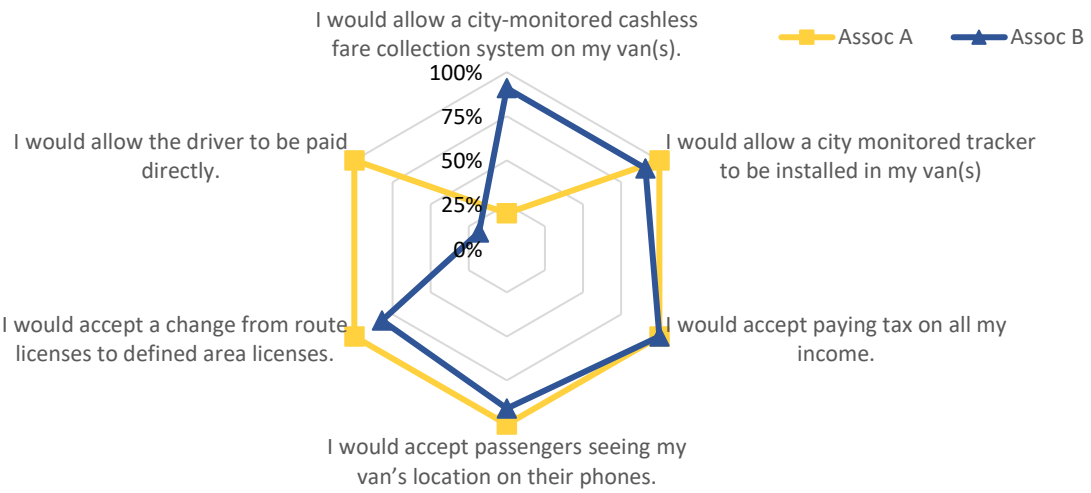
Many respondents from Assoc A switched responses for CFC acceptance to no for this intervention. From discussion, it seems this was due to the fact that no incentives are being paid so the City should not be able to access this information. However, the app would be paid for by government which can be thought of as an incentive, though this stance by Assoc A owners suggests it may take some convincing on the part of government officials before data could be monitored. The associations differ significantly for the CFC indicator with a large Cramer's V effect size of 0.709 (p=0.005).

Table 37. Individual responses for E-hailing.

	Assoc A	Assoc B	Assoc C	Assoc D	Assoc E
I would allow a City-monitored cashless fare collection system on my van(s).	20%*	91%*	100%	100%	100%
I would allow a City-monitored tracker to be installed in my van(s)	100%	91%	100%	100%	100%
I would accept paying tax on all my income.	100%	100%	100%	100%	100%
I would accept passengers seeing my van's location on their phones.	100%	91%	100%	0%	100%
I would accept a change from route licenses to defined area licenses.	100%	82%	100%	0%	100%
I would allow the driver to be paid directly.	100%*	18%*	100%	100%	100%
Aggregated individual responses	100%	82%	100%	100%	100%
Group response					

Notes:
– Assoc A n=5; Assoc B n=11; Assoc C, Assoc D, and Assoc E n=1 each.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Figure 37. Individual responses for E-hailing.



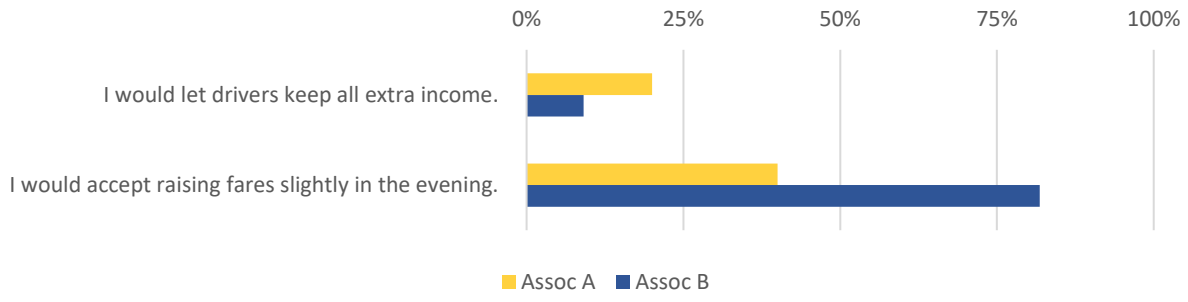
For Higher evening fare, the primary point of resistance is letting drivers keep extra income. Assoc A is more resistant to raising fares than Assoc B which, despite some acceptance for indicators, follows through to both individual and group responses for the intervention overall. On the other hand, Assoc B is accepting of Higher evening fare. There was a significant difference between the two for this indicator with a large Cramer's V effect size of 0.533 (p=0.039).

Table 38. Individual responses for Higher evening fare.

	Assoc A	Assoc B	Assoc C	Assoc D	Assoc E
I would let drivers keep all extra income.	20%	9%	100%	100%	100%
I would accept raising fares slightly in the evening.	40%*	82%*	100%	100%	100%
Aggregated individual responses	0%*	91%*	100%	100%	100%
Group response					

Notes:
– Assoc A n=5; Assoc B n=11; Assoc C, Assoc D, and Assoc E n=1 each.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Figure 38. Individual responses for Higher evening fare.



Owner responses regarding tax obligations were consistent, which is somewhat surprising considering the conventional wisdom that MBT operators prefer cash as a way to avoid taxation. While discussion showed that owners would probably prefer not to pay, most seemed willing to fulfill this obligation because it seems unavoidable. Most likely this is a sentiment shared with most in the general population of South Africa.

Clearly two points of resistance have risen to the top: letting drivers keep extra income and allowing government to pay driver incentives directly. Headway bonus appears to elicit strong reactions from owners, demonstrating some key differences in indicator responses compared to the same indicators in other interventions. Indicator acceptance for Off peak contract is high, and often unanimous.

Assoc A, Assoc B, and Assoc C respondents all called for the MBT industry to be subsidized. Assoc A respondents made a clear connection between low demand in evening periods—when services are unviable for operations when drivers must pay for fuel and owners must pay for additional maintenance—and the need for government support. Assoc B and Assoc C respondents specifically called for subsidy like that given to GABS on a per kilometer basis, with the respondent from Assoc C suggesting this would only be necessary during periods of low demand and services could remain unscheduled and unsubsidized during peak periods. Assoc B owners feel they are providing a service for government and should therefore be supported. The Assoc E respondent summarized it well, stating that the “city doesn’t have anything to do with our business now.”

Table 39. Statistical comparison of indicator acceptability for Mitchells Plain associations.

		N-1 Chi square	p-value[1]	Cramer's V	p-value
Rank security	I would let drivers keep all extra income.	0.091	0.763	0.078	0.755
Transfer bonus	I would allow a City-monitored cashless fare collection system on my van(s).	0.455	0.500	0.174	0.486
	I would allow a City-monitored tracker to be installed in my van(s).	0.455	0.500	0.174	0.486
	I would accept paying tax on all my income.	0.500	0.480	0.189	0.464
	I would let drivers keep all extra income.	0.974	0.324	0.255	0.308
	I would allow the driver to be paid directly.	0.243	0.622	0.127	0.611
Headway bonus	I would allow a City-monitored tracker to be installed in my van(s).	4.667	0.031	0.577	0.025
	I would let drivers keep all extra income.	no test - 100% no			
	I would allow the driver to be paid directly.	4.714	0.03	0.561	0.025
Operating deficit payment	I would allow a City-monitored cashless fare collection system on my van(s).	0.000	1.000	0.000	1.000
	I would allow a City-monitored tracker to be installed in my van(s).	1.077	0.299	0.277	0.283
	I would accept paying tax on all my income.	0.500	0.48	0.189	0.464
	I would let drivers keep all extra income.	no test - 100% no			
	I would allow the driver to be paid directly.	1.750	0.186	0.354	0.171
Off peak contract	I would allow a City-monitored cashless fare collection system on my van(s).	2.200	0.138	0.383	0.126
	I would allow a City-monitored tracker to be installed in my van(s)	no test - 100% yes			
	I would accept paying tax on all my income.	no test - 100% yes			
	[Association name] should form a company.	no test - 100% yes			
	There should be fewer vans at [association name].	no test - 100% yes			
	I would shift to a company structure that may give me less control over my business.	no test - 100% yes			
	I would trust the company to pay me what I am due.	no test - 100% yes			
E-hailing	I would allow a City-monitored cashless fare collection system on my van(s).	7.542	0.006	0.709	0.005
	I would allow a City-monitored tracker to be installed in my van(s)	0.455	0.500	0.174	0.486
	I would accept paying tax on all my income.	no test - 100% yes			
	I would accept passengers seeing my van's location on their phones.	0.455	0.500	0.174	0.486
	I would accept a change from route licenses to defined area licenses.	0.974	0.324	0.255	0.308
	I would allow the driver to be paid directly.	8.766	0.003	0.764	0.002
Higher evening fare	I would let drivers keep all extra income.	0.351	0.554	0.153	0.541
	I would accept raising fares slightly in the evening.	3.977	0.046	0.533	0.039

Notes:
– [1] Two-sided significance.
– Green indicates significance at 0.05 level.

7.2.3.2 Disaggregated individual indicator acceptability – location comparison

This section discusses the perspective of owners from associations outside of Mitchells Plain to give some indication of whether Mitchells Plain is unique. From an overall assessment of the 29 indicators across seven interventions, responses from Mitchells Plain associations significantly differed from

responses for others for only seven instances of 29 total indicators, or 24 percent (Table 47). Differences were found only in two indicators, allowing drivers to keep extra income and for them to be paid bonuses directly by government. This may suggest that Assoc A and Assoc B are not completely unique regarding perspectives on reform. Despite some differences in perspective and some new information, much of the sentiments shared in interviews with additional association representatives echoed those expressed within the MP focus groups. While this may not be considered full saturation, the limitations around participant willingness discussed in *7.1.1 Administration* above highlight the difficulty in getting additional data. After interviews were complete, I attempted to use the snowball technique to obtain additional one-on-one interviews with those within the same association, with no success. With the pool of eligible respondents exhausted, I analyzed the information I had collected.

For Rank security, the groups differed for the only indicator; Mitchells Plain associations were not willing to let drivers keep extra income while the three individuals from other associations were unanimously willing (Table 40). This pattern of difference continues for every instance of the extra income indicator as listed below in Table 41, Table 42, Table 43, and Table 46. All effect sizes are large, with perfect association for Headway bonus and Operating deficit payment (Cohen, 1988).

- Rank security: Cramer's V of 0.567 (p=0.013)
- Transfer bonus: Cramer's V of 0.725 (p=0.002)
- Headway bonus: Cramer's V of 1.000 (p=0.000)
- Operating deficit payment: Cramer's V of 1.000 (p=0.000)
- Higher evening fare: Cramer's V of 0.725 (p=0.002)

While owners in Mitchells Plain felt they needed to benefit from bonuses to cover maintenance costs, owners at Assoc D and Assoc E, as discussed above, have unique arrangements that shift maintenance costs to others and impact their responses to this indicator. The owner from Assoc C, while responding yes to these indicators, recognized that additional driver earning is important but felt that owners needed additional revenue to pay for increased maintenance and for vehicle replacement, echoing the perspective of those in Assoc A and Assoc B.

The groups also differed for the direct payment indicator. Of the four instances of this indicator, differences were not significant for E-hailing or Transfer bonus (Table 41, Table 45) but were for the other two:

- Headway bonus: Cramer's V of 0.725 (p=0.002)
- Operating deficit payment: Cramer's V of 0.632 (p=0.007)

Both Assoc C and Assoc D respondents stated that direct payment was acceptable because it would be easier for them not to be involved. In Mitchells Plain however, the need for control over the business was the main reason behind responses against government paying drivers directly.

One note regarding the group response in Table 42, Table 43, and Table 46: the cell is split and colored both red and green because the Mitchells Plain associations differed in response. Assoc A as a group was willing to accept Headway bonus and Operating deficit payment but not Higher evening fare; Assoc B gave opposite responses.

Table 40. Rank security responses compared by association location.

	MP	Others
I would let drivers keep all extra income.	25%*	100%*
Aggregated individual responses	100%	100%
Group response		

Notes:
– Assoc A n=5; Assoc B n=11; Assoc C, Assoc D, and Assoc E n=1 each.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Table 41. Transfer bonus responses compared by association location.

	MP	Others
I would allow a City-monitored cashless fare collection system on my van(s).	94%	100%
I would allow a City-monitored tracker to be installed in my van(s).	94%	100%
I would accept paying tax on all my income.	88%	100%
I would let drivers keep all extra income.	13%*	100%*
I would allow the driver to be paid directly.	69%	100%
Aggregated individual responses	88%	100%
Group response		

Notes:
– Assoc A n=5; Assoc B n=11; Assoc C, Assoc D, and Assoc E n=1 each.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Table 42. Headway bonus responses compared by association location.

	MP	Others
I would allow a City-monitored tracker to be installed in my van(s).	56%	100%
I would let drivers keep all extra income.	0%*	100%*
I would allow the driver to be paid directly.	13%*	100%*
Aggregated individual responses	25%	100%
Group response		

Notes:
– Assoc A n=5; Assoc B n=11; Assoc C, Assoc D, and Assoc E n=1 each.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Table 43. Operating deficit payment responses compared by association location.

	MP	Others
I would allow a City-monitored cashless fare collection system on my van(s).	75%	100%
I would allow a City-monitored tracker to be installed in my van(s).	81%	100%
I would accept paying tax on all my income.	88%	100%
I would let drivers keep all extra income.	0%*	100%*
I would allow the driver to be paid directly.	19%*	100%*
Aggregated individual responses	56%	100%
Group response		

Notes:
– Assoc A n=5; Assoc B n=11; Assoc C, Assoc D, and Assoc E n=1 each.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Table 44. Off peak contract responses compared by association location.

	MP	Others
I would allow a City-monitored cashless fare collection system on my van(s).	94%	100%
I would allow a City-monitored tracker to be installed in my van(s)	94%	100%
I would accept paying tax on all my income.	100%	100%
[Association name] should form a company.	100%	100%
There should be fewer vans at [association name].	100%	100%
I would shift to a company structure that *may* give me less control over my business.	100%	100%
I would trust the company to pay me what I am due.	100%	100%
Aggregated individual responses	100%	100%
Group response		

Notes:
– Assoc A n=5; Assoc B n=11; Assoc C, Assoc D, and Assoc E n=1 each.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Table 45. E-hailing responses compared by association location.

	MP	Others
I would allow a City-monitored cashless fare collection system on my van(s).	69%	100%
I would allow a City-monitored tracker to be installed in my van(s)	94%	100%
I would accept paying tax on all my income.	100%	100%
I would accept passengers seeing my van's location on their phones.	94%	67%
I would accept a change from route licenses to defined area licenses.	88%	67%
I would allow the driver to be paid directly.	44%	100%
Aggregated individual responses	88%	100%
Group response		

Notes:
– Assoc A n=5; Assoc B n=11; Assoc C, Assoc D, and Assoc E n=1 each.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Table 46. Higher evening fare responses compared by association location.

	MP	Others
I would let drivers keep all extra income.	13%*	100%*
I would accept raising fares slightly in the evening.	69%	100%
Aggregated individual responses	63%	100%
Group response		

Notes:
– Assoc A n=5; Assoc B n=11; Assoc C, Assoc D, and Assoc E n=1 each.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Table 47. Statistical comparison of indicator acceptability, Mitchells Plain associations v. others.

		N-1 Chi square	p-value[1]	Cramer's V	p-value
Rank security	I would let drivers keep all extra income.	5.786	0.016	0.567	0.013
Transfer bonus	I would allow a City-monitored cashless fare collection system on my van(s).	0.188	0.665	0.102	0.656
	I would allow a City-monitored tracker to be installed in my van(s).	0.188	0.665	0.102	0.656
	I would accept paying tax on all my income.	0.200	0.655	0.108	0.645
	I would let drivers keep all extra income.	9.450	0.002	0.725	0.002
	I would allow the driver to be paid directly.	1.205	0.272	0.259	0.259
Headway bonus	I would allow a City-monitored tracker to be installed in my van(s).	1.700	0.192	0.316	0.180
	I would let drivers keep all extra income.	18.000	0.000	1.000	0.000
	I would allow the driver to be paid directly.	9.450	0.002	0.725	0.002
Operating deficit payment	I would allow a City-monitored cashless fare collection system on my van(s).	0.680	0.410	0.200	0.396
	I would allow a City-monitored tracker to be installed in my van(s).	0.425	0.514	0.158	0.502
	I would accept paying tax on all my income.	0.200	0.655	0.108	0.645
	I would let drivers keep all extra income.	17.000	0.000	1.000	0.000
	I would allow the driver to be paid directly.	6.800	0.009	0.632	0.007
Off peak contract	I would allow a City-monitored cashless fare collection system on my van(s).	0.188	0.665	0.102	0.656
	I would allow a City-monitored tracker to be installed in my van(s)	no test - 100% yes			
	I would accept paying tax on all my income.	no test - 100% yes			
	[Association name] should form a company.	no test - 100% yes			
	There should be fewer vans at [association name].	no test - 100% yes			
	I would shift to a company structure that may give me less control over my business.	no test - 100% yes			
	I would trust the company to pay me what I am due.	no test - 100% yes			
E-hailing	I would allow a City-monitored cashless fare collection system on my van(s).	1.205	0.272	0.259	0.259
	I would allow a City-monitored tracker to be installed in my van(s)	0.188	0.665	0.102	0.656
	I would accept paying tax on all my income.	no test - 100% yes			
	I would accept passengers seeing my van's location on their phones.	1.864	0.172	0.322	0.161
	I would accept a change from route licenses to defined area licenses.	0.781	0.377	0.208	0.364
	I would allow the driver to be paid directly.	3.038	0.081	0.411	0.073
Higher evening fare	I would let drivers keep all extra income.	9.450	0.002	0.725	0.002
	I would accept raising fares slightly in the evening.	0.971	0.324	0.239	0.310

Notes:
– [1] Two-sided significance.
– Green indicates significance at 0.05 level.

7.2.4 Summary

Because aggregated individual responses for intervention acceptability aligned with group responses, the individual responses are summarized here and are used to compare to driver acceptability in chapter 8 (*Implementation Feasibility*). Only data from Mitchells Plain is summarized here because no

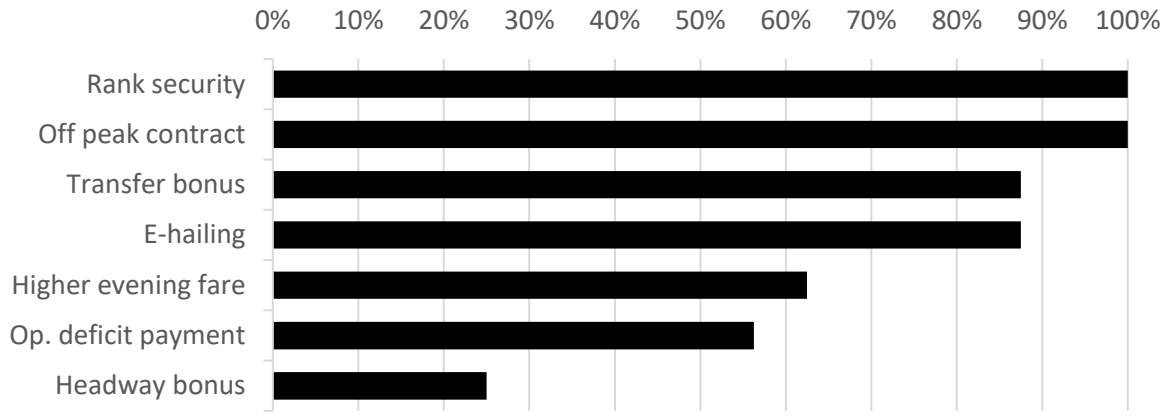
driver data is available from Assoc C, Assoc D, or Assoc E and therefore further comparison and analysis focuses only on Assoc A and Assoc B. Table 48 combines data presented above in Table 26 and Table 28 to succinctly show the owner perspective on interventions, ordered from most to least acceptable in the first column. Figure 39 shows only combined acceptability.

Table 48. Percent of individuals from Mitchells Plain associations willing to accept interventions.

Intervention	Combined	Assoc A	Assoc B
Rank security	100%	100%	100%
Off peak contract	100%	100%	100%
Transfer bonus	88%	100%	82%
E-hailing	88%	100%	82%
Higher evening fare	63%	0%*	91%*
Op. deficit payment	56%	100%*	36%*
Headway bonus	25%	80%*	0%*

Notes:
– Combined n=16; Assoc A n=5; Assoc B n=11.
– * Significantly different at 0.05 level.
– Green = 100%, yellow = 50-99%, red < 50%.

Figure 39. Aggregated owner intervention acceptability.

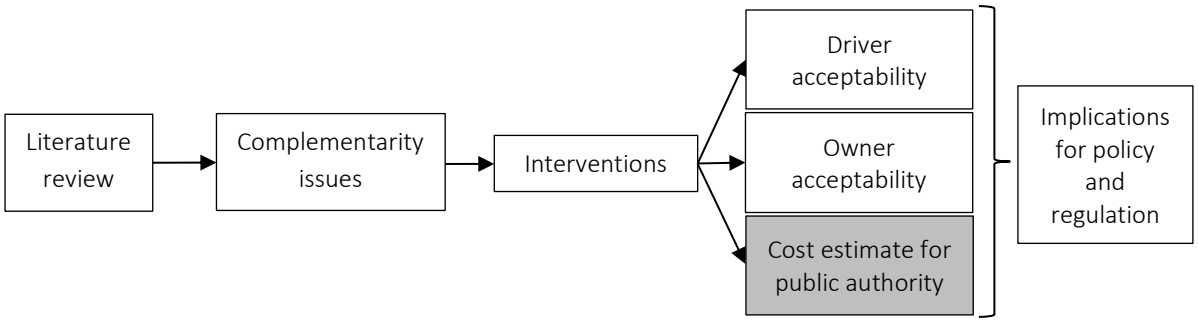


There appear to be four tiers of acceptability, with Rank security and Off peak contract most acceptable, followed by Transfer bonus and E-hailing, then Higher evening fare and Operating deficit payment, and lastly by Headway bonus which is the least acceptable intervention by a considerable margin.

As discussed in chapter 6 (*Drivers*), acceptability of interventions from the driver perspective were affected by tax obligations; if drivers were exempted from tax, acceptability of interventions increased. This is not the case among owners as almost all respondents were willing, and consistently willing, to pay tax on income earned through their MBT businesses. This is an interesting difference that may be due to the capacity-building program and TOC pilot which drivers were not as involved in,

or possibly due to the fact that drivers consider their income too low to reasonably expect them to pay tax, which was stated by some in unstructured discussions. While it is difficult to say why, the results suggest that a tax exemption may be a more limited policy lever than driver results indicated. Policy implications and recommendations are detailed in chapter 9 (*Discussion*). Details on tax implications for owners can be found in chapter 5 (*Interventions*).

8 Implementation Feasibility



This chapter extends and synthesizes research findings to determine what interventions are likely most feasible to implement by combining the data collected through mixed methods. Extension comes in the form of operational cost estimates for each intervention to understand the financial sustainability of each; considering one of the main concerns stemming from MyCiTi Phase 1 implementation is the high costs of operating scheduled BRT services, alternatives to this approach must be more cost effective. The first part of this chapter speaks to this (*8.1.2 Estimation results*).

Following this, later sections of the chapter synthesize the driver and owner acceptability of interventions and combines this information with the estimated costs as well as four additional criteria within a multi-criteria analysis framework (*8.2.1 Multi-criteria analysis method*). The results provide an indication of which interventions are most feasible from the industry perspective, from government's perspective based on cost and other factors (as described in *8.2.2 Acceptability*), and from the passenger's perspective by what complementarity issues each addresses (service span mismatch and long off peak headways, as described in chapter 3 *Research Context*).

The information presented in this chapter sets the stage for a discussion of policy implications in the next chapter, 9 *Discussion*.

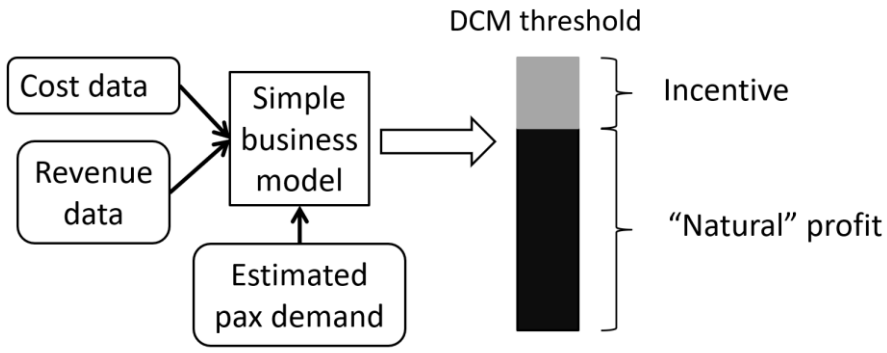
8.1 Intervention costs

8.1.1 Estimation method

While the final result of this research recommends the most preferred interventions from the industry perspective, the cost to the City is a critical factor determining which intervention is pursued. This section describes how the costs of these interventions were determined. Costs are intended to be order of magnitude estimates rather than exact costs to provide an indication of what reforms may be most feasible overall.

Figure 40 outlines the method used to determine costs for four of the seven interventions, namely Operating deficit payment, Transfer bonus, Headway bonus, and Higher evening fare. The central component is the simple business model developed from extensive interaction with Assoc A drivers, owners, and owner-drivers both through the initial focus group discussion and many unstructured discussions, which Gillham (2000) describes as a viable method for obtaining data without the formal arrangement of interviews. Driver survey responses and expert feedback were also used to inform values used for cost and revenue data inputs. The survey provided driver median daily profit and trips; fuel usage information, target payment amounts and commission percentages, lines fees, and gaartjie earnings (as a driver cost) were sourced from drivers and to some degree owners and then triangulated with experts; and an estimate of the number of passengers boarding along the route was determined from previous research on Assoc A departure headways (Behrens, Hawver, et al., 2017). Each trip has at least 15 passengers because vans depart the rank when full, but each association has varying numbers of passengers picked up along the route, which also varies by time of month, time of day, and quality of vehicle. The resulting business model treats each association separately at the detailed level, with differing values for passengers boarding along the route, fuel consumption (due to vehicle and route differences), etc. based on the best possible estimations for all values.

Figure 40. Intervention cost calculation approach. Note: DCM is discrete choice model.



Median trips per day from the survey were added to Assoc A and Assoc B models and the model output was compared to the survey results for median daily profit. Because the two align, the model was deemed appropriate to use for further analysis. Daily trip counts remained constant while additional evening trip counts varied by intervention. During the day, an Assoc A driver is assumed to pick up four passengers along the route while one from Assoc B picks up eight, but evening passengers per trip for both associations are assumed to be only 15 (assuming no additional passengers boarding along the route) because most demand will be outgoing from the PTI and few people will be traveling for reasons other than returning home from work as shops are closed at this time. Fuel consumption is based on the dominant vehicle at each association, the CAM Inyathi for

Assoc A and the Toyota Quantum at Assoc B. Among survey respondents, only 36 percent of Assoc A drivers have conductors while 100 percent of Assoc B drivers do; these costs were input accordingly. The final input was lines fees, which drivers pay per day at Assoc A so these costs were split across all trips. At Assoc B, owners pay lines fees out of their commission, so this cost was set to zero for drivers.

Passenger demand is difficult to estimate and no data could be sourced to support calculations. Attempts were made to obtain CCTV footage from the Passenger Rail Agency of South Africa to allow an estimation of passengers disembarking from trains at the PTI (as a major source of passengers for MBTs in this area), but initial responsiveness failed to produce footage. The final approach used known values from earlier in the day to calculate proportionally the expected number of passengers in the evening period of interest from 7 to 10 pm. Using the Metrorail schedule, the number of train arrivals at the Mitchells Plain PTI were recorded for each hour from 6 pm to 10 pm. Previous research with Assoc A documented an average of four MBT departures during the 6 pm hour (Behrens, Hawver, et al., 2017); assuming vehicles depart full, this is 60 passengers total or approximately 10 passengers per train arrival. It is also assumed that all passengers have arrived on trunk PT rather than originated trips at the PTI because shops are closed at this time in the evening. Based on the train arrivals, expected passengers were calculated for the 7, 8, and 9 pm hours to obtain an estimated total of 48 passengers from 7 to 10 pm per association (96 total).

While this method is defendable, there remain concerns about the lack of train ridership data in general and passenger movements for Mitchells Plain PTI in particular during these times. Train reliability has also declined significantly over the course of research, suggesting that even fewer individuals are using this mode. Discussions with experts suggest many people may use a MBT-train combination trip in the morning, but use a different journey on the return because of a lack of MBT services available. Latent demand is difficult to quantify; it may be that passenger demand will grow if services are provided. Indeed, Gautrain midibus ridership grew significantly year on year, measured in October, from the first to the second year of service (Semake & Nortje, 2018). During the focus group with Assoc A, it was communicated that services used to be provided later into the evening, but that passenger demand has declined and made it unviable to continue. This is a difficult situation where MBT operators are heavily dependent on train operations that are outside of their control. However, the question of how to match feeder service to trunk services in this environment remains important regardless of the level of need in this particular case or at this particular time; eventually it is hoped that Metrorail services will improve, attracting back passengers that have been lost. And, while

focused on Mitchells Plain, this research is intended to highlight potential approaches for feeder-trunk complementarity more generally.

With the business model complete, it is then used to calculate an aggregate (across both associations) cost estimate for each of the four interventions. Costs were calculated for the additional three hours of service between 7 and 10 pm for 260 weekdays per year. Demand patterns are different on Saturdays and Sundays across both associations, so these days were excluded (Behrens, Hawver, et al., 2017). Survey work as part of the TOC pilot undertaken by the City suggests that half of Assoc B passengers use the service five days each week while the remainder use the service less frequently, corroborating the use of weekdays as the focus of the estimate (Saddier et al., 2019).

Cost estimates only include direct operational costs to the City in the form of incentives; payment administration, monitoring, contract management, and other such costs are excluded. This operational cost includes the service fees associated with vehicle tracking which were estimated from conversations with Netstar, a company providing such services in South Africa. For a large fleet, a discount from list price is provided for the Plus service described on their website which includes real-time tracking, trip reports, theft recovery, and other services (Netstar, n.d.). The discounted monthly cost of ZAR 139 per month per vehicle requires a 36 month contract and includes the cost of the units and installation. This means that this is not strictly an operational cost and therefore the tracking cost for the interventions that require it (Transfer bonus, Operating deficit payment, and Headway bonus) is somewhat high, though a reasonable estimate.

Inputs to the business model were adjusted based on the conditions of each intervention to determine the level of profit drivers would earn and how much the City would need to top up these earnings to ensure a reasonable chance of drivers agreeing to provide service. In this case, a probability of 70 percent was chosen as the threshold. This probability of providing service is given by the discrete choice model developed from driver choice task data; the model provides a Rand value that drivers must make over the three hours of additional service to produce a particular percent chance of a driver agreeing to provide service. The cost to the City for each intervention is the difference between this amount drivers must make and the profit they earn from fare revenue minus costs. As discussed in chapter 6 (*Drivers*), the model used for this was the reduced ordered choice model that includes only the profit and security attributes. The model did not include sociodemographic characteristics because the City would not pay varying amounts based on these characteristics as this is likely to create tension within associations (chapter 6 *Drivers*).

Higher evening fare maintains the status quo but increases the fare by ZAR 1 per trip to ZAR 8 for Assoc A and ZAR 9 for Assoc B (an average increase of 13.33 percent). Because the fare has increased, it is likely that this will reduce estimated demand compared to other interventions. An elasticity of -0.40 was used to estimate this effect on demand based on meta-analyses of elasticity values that found bus elasticity values with respect to fare between -0.30 and -0.50, though generally in higher income countries (Litman, 2004; Paulley et al., 2006). An additional meta-analysis found a mean bus elasticity with respect to fares of -0.38 across 81 studies, though again mostly in higher income countries (Holmgren, 2007). Guzman, Gomez & Moncada (2019) found fare elasticity values for BRT of -0.408; while this is a low and middle income country, it may not be directly transferable because of the mode difference. Unfortunately, no elasticities could be found for paratransit services, let alone in South Africa. Using the value of -0.40, passenger demand is estimated to decrease 5.33 percent to 46, two passengers less than status quo estimations; with three full trips, only one passenger remains so drivers will likely overload the final departure to avoid taking an additional loss-making trip. Passengers in this area of the city are generally low income so it is likely that if fares were increased, some demand would be reduced in this way. Passengers may take another PT route home or ask friends or family with private vehicles to pick them up at the PTI, but few will choose to walk instead because of safety and security issues.

The Transfer bonus intervention assumes that all 15 passengers qualify for a bonus payment because shops at the Mitchells Plain PTI are closed by 7 pm and therefore all passengers will likely transfer from trunk services. With a ZAR 1 bonus, drivers will receive an additional ZAR 15 per trip. Despite the change to CFC, driver costs and earnings are assumed to remain the same as under a cash system.

The Headway bonus is set at ZAR 50 per trip that departs within 30 minutes of the previous departure from the rank. If achieved, passengers would only wait an average of 15 minutes when transferring. While this may be longer than ideal, it is a reasonable off peak headway when comparing to the MyCiTi feeder routes selected for comparison based on similarity to current MBT services in this area (Table 49). No bonus is paid to drivers that depart outside of the time limit. This intervention requires that two drivers/vehicles operate because cycle times for the routes are approximately 30 minutes each. It is likely that drivers will wait until the very last moment to depart while still earning the bonus payment to ensure the maximum number of passengers and therefore earnings.

The Operating deficit payment involves a variable cost to the City based on how many passengers a driver carries per trip. The City pays any deficit and guarantees a ZAR 20 profit per trip. This was necessary to ensure drivers would provide service; breaking even on service would not be attractive enough to convince drivers to work longer hours into the evening. There is some risk that drivers will

provide unnecessary trips simply to earn the guaranteed profit, though this is hopefully a small risk because this amount is approximately half what a driver would make on a normal trip during the day. However, the City could cap the amount or number of trips to limit risk.

The remaining interventions each use unique methods for estimating cost. The Rank security intervention cost consists only of the SAPS officer salary for three hours in the evening. An hourly rate was calculated from an average annual constable salary. This number was then multiplied by three hours and by 248 standard weekdays per year. The remaining 12 days are public holidays and the hourly rate was double for these days as required by the Basic Conditions of Employment Act (Department of Labour, 2016). While there may be some cost saving potential by amending the current private security contract for the PTI (TDA, 2018b), cost estimates assume that it will remain unchanged and a SAPS officer will be additional.

E-hailing costs pertain to app development and maintenance. The business model cannot be used here because it is based on the current route and fare; e-hailing involves on-demand routing and distance- and time-based fares. Two quotes for app development were obtained from Cape Town-based PT technology companies and averaged in the same year Rand. Annual maintenance costs were calculated as 17.5 percent of development costs (Chomko, 2012; Patil, 2017). Annualized development costs (over five years) were added to annual maintenance costs to obtain an annual cost for the e-hailing app, which was then divided by the estimated number of feeder associations in Cape Town. The Operating License Strategy lists 102 MBT associations in the city (TDA, 2014) and research suggests that 22 percent of sampled routes are likely feeders with short distances, slower speeds, and higher stop densities as well as starting or ending at one of the city's top 10 busiest PTIs (Du Preez et al., 2019); assuming most associations operate more than one route, a value of 11 percent was used to estimate the number of feeder associations of 11. The result is an annual cost per association. This cost does include some capital cost (app development), but this is unavoidable considering the structure of the phone-based app that includes all aspects of operations tracking, etc.

Cost of the contract intervention was determined using existing MyCiTi Phase 1 feeder route operational data. Three routes (231, 234, and 237) were selected based on similarities between the Assoc A and Assoc B route characteristics as well as the demographics of the area each route serves. Atlantis, a satellite city developed under apartheid whose population is now dependent on employment in Cape Town, serves as a good comparison area to Mitchells Plain because of similar sociodemographic characteristics. Most of the characteristics of the Atlantis and MBT routes are extremely comparable as shown in Table 49. Service end time and service hours show the greatest discrepancy, which is natural considering the goal of the research is to identify ways to increase MBT

service span. Maximum headways are quite comparable, but minimum headways are considerably shorter for MBTs, a common feature of paratransit as discussed in chapter 2 (*Literature Review*).

Table 49. Data compared for MyCiTi and MBT route operational data.

Characteristic	MyCiTi Average	MBT Average
Average speed (km/hr)	26	27.2
Round trip distance (km)	12.7	11.6
Round trip time (min)	30	27.5
Average fare (ZAR)	7.40	7.50
Monthly revenue per km (ZAR)	10.15	12.28
Service start time	4:54	4:30
Service end time	21:00	19:00
Service hours	16:06	14:30
Minimum headway (min)	25	0
Maximum headway (min)	50	48
Headway after 7 pm, Monday-Friday (min)	38	No service

Sources: MyCiTi: service times and headways from September 2018 timetables; speed, distance, time, fare, and revenue from TDA September 2017. MBT: speed, distance, time, fare, and revenue from September 2017 original research; service times and headways for Assoc A from Hawver (2016) and Assoc B from original research September 2017.

Cost and revenue data was obtained from the City for the three MyCiTi feeder routes. Marginal costs, rather than total costs, were used because total costs include fixed costs such as depots and administrative staff that would not be considerably increased were a few new routes added to the system. The total operating deficit for September 2017 (because data collection for MBTs occurred around this time) was determined by subtracting marginal costs from revenue. However, to obtain full costs, maintenance costs had to be calculated and added to marginal costs for the kilometers that were operated using nine meter buses because maintenance is on a separate contract. Total operated kilometers by route were multiplied by a calculated per kilometer maintenance cost based on contract total value and duration. Because route 234 was operated with both 12 and nine meter buses at this time, maintenance costs were only added for the kilometers operated with nine meter buses.

Once the total operating deficit per month was calculated, a deficit per service hour was determined by adding all service hours for September 2017 and dividing the overall deficit amount by the total service hours. Service hours were calculated based on the timetables and the number of each type of day (weekday, Saturday, Sunday, and Public Holiday). Multiplying by 3 hours resulted in a comparable daily cost to extended MBT service for the period of interest from 7 pm to 10 pm and multiplying by 260 produced an annual cost for this service.

MyCiTi contract costs do not include the cost of automatic fare collection because this is obtained under a separate contract in line with best practices in transport contracting. Because of this, the cost

of operating a CFC system is excluded for the other interventions that require it outside of an app (Transfer bonus and Operating deficit payment) to ensure a comparable value.

8.1.2 Estimation results

Table 50 and Figure 41 show the results of cost estimations stemming from the above method. Off peak contract is the most expensive of the seven interventions by a factor of 2.3. Because Higher evening fare is a cost to passengers rather than a cost to the public authority, it is the least expensive intervention for government. All cost estimates are based on an assumed passenger demand as described above, but an interesting thing to note is the differing impact increased passenger demand would have on each intervention's costs. For Operating deficit payment, the cost to the City would decrease because the deficit to be paid by the City would shrink. In contrast, costs would increase for Headway bonus, Transfer bonus, Off peak contract, and Higher evening fare as more trips and passengers qualify for bonus payments and additional kilometers of service are supplied. Higher evening fare costs increase proportional to passengers; as each one pays the increased fare, the aggregate cost to passengers increases. Costs for E-hailing and Rank security would remain constant because the app and salaries are not affected by demand.

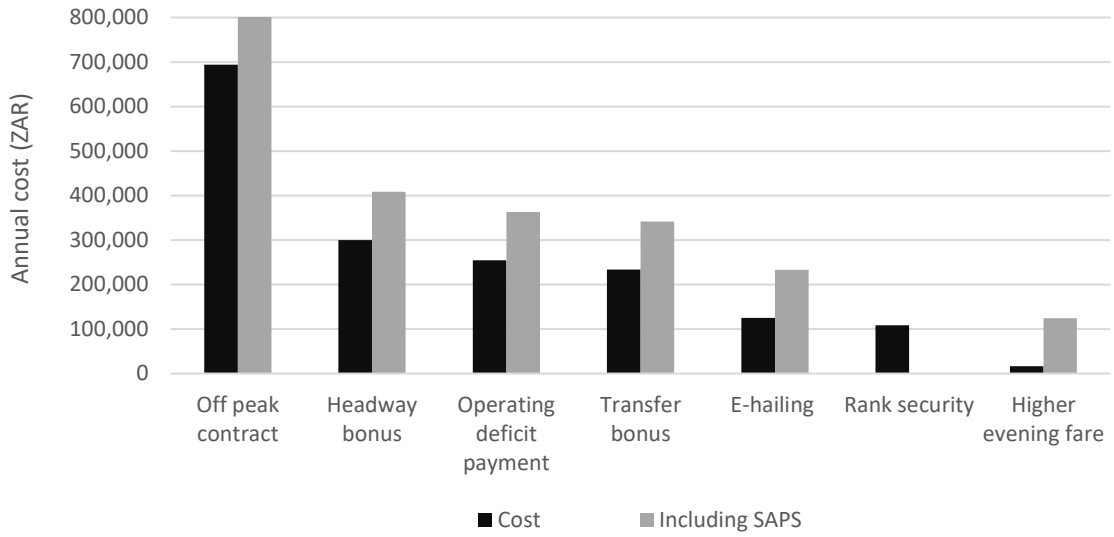
In light of the findings that owners are resistant to drivers keeping all extra money earned on additional trips, mainly because of concerns over increased maintenance cost, there may be a need to increase the incentive (or higher fare) paid to ensure that if owners increase targets or calculate commission including additional driver earnings drivers will continue to be incentivized at the appropriate level to induce improved service. The cost of four interventions would increase in this case: Transfer bonus, Headway bonus, Operating deficit payment, and Higher evening fare. However, increasing the incentive amount may not make a major impact on the total cost of the first three interventions listed because tracking costs make up a large proportion of total costs for Transfer bonus (95 percent), Headway bonus (74 percent), and Operating deficit payment (88 percent). This technology brings additional benefits beyond providing improved evening services, including route enforcement, demand assessment, and streamlining 180-day surveys to determine whether OLs are being actively used. If the total vehicle fleet was reduced, this cost would decrease as the costs reflect a per vehicle per month fee. Despite the high cost, tracking devices are an essential subcomponent of these interventions to prevent cheating by operators.

Table 50. Estimate of annual costs for each intervention.

Intervention	Annual cost (ZAR)	Annual cost incl. SAPS (ZAR)
Off peak contract	694,095	802,285
Headway bonus	299,972	408,163
Operating deficit payment	254,764	362,954
Transfer bonus	233,672	341,863
E-hailing	124,700	232,890
Rank security	108,191	N/A
Higher evening fare	16,120[1]	16,120 + 108,191[2]

Notes:
– [1] Aggregate cost to passengers, not the public authority.
– [2] Aggregate cost to passengers plus cost to public authority for officer salaries.

Figure 41. Estimate of annual costs for each intervention.



Notes: All are costs to public authority except Higher evening fare, which is an aggregate cost to passengers.

If the City rolls out an integrated ticketing system that allows for discounted or free transfers, the cost of these interventions would increase because reducing the cost to passengers directly reduces the profitability of MBT trips; this additional shortfall would need to be paid by the City to continue to maintain a high probability of drivers providing evening services as these interventions are intended to do. Because CFC costs are not included for the three interventions that require this technology (Off peak contract, Operating deficit payment, and Transfer bonus), the total cost of these interventions if implemented are higher. For Off peak contract, this simply means that it continues to be far more expensive than others; for the other two interventions, costs may increase above that of Headway bonus.

Table 50 and Figure 41 also present intervention costs if a SAPS officer were to be posted at each rank in addition to the intervention listed, essentially adding the Rank security intervention onto each

other intervention. As discussed in earlier chapters, owners and drivers from Assoc A strongly communicated the need for improved security at the rank (chapter 6 *Drivers*) and two surveys of passengers, one by the City and one by independent researchers, found that security at the rank is a major concern (chapter 5 *Interventions*) (Behrens et al., 2018; Yellowwood, 2018). This evidence suggests that the Rank security intervention could be a valuable addition to any intervention and costs of these scenarios are therefore included here. Costs to the City would of course increase, but the higher cost might be justified simply to ensure passenger safety and security. Notwithstanding cost, the high acceptability among both drivers and owners means there would be little resistance.

One interesting item to note relates to the TOC pilot outcomes with Assoc B. It appears that scheduled services can be run profitably if conductors are no longer employed; with them, the system operates at a loss. This would seem to contradict the cost estimate for Off peak contract which is then almost ZAR 700,000 more expensive assuming no conductors; however, this is the cost for both associations and the TOC pilot included just one. Therefore the comparable cost estimate is ZAR 374,048. This difference may be due to the fact that while the Atlantis MyCiTi routes are quite similar to the MBT routes run by Assoc A and Assoc B, the context is different. Fuel and maintenance are likely more expensive for MyCiTi operations due to the larger and more complex vehicle and negotiated contracts may have been more expensive to reduce resistance and delay in launch. Some evidence does corroborate the potential for Assoc B to run profitable services; modelling done by Del Mistro & Behrens (2015) found that under current conditions, only MBT routes less than five kilometers operate at a profit. Assoc A and Assoc B routes are under this threshold and with a reduced fleet stemming from scheduled services, it may be reasonable that the pilot shows profitable operations, though not without some loss of employment, a major point of tension in implementation of MyCiTi Phase 1.

8.2 Overall intervention acceptability

8.2.1 Multi-criteria analysis method

Knowing the perspective of drivers and owners separately, as detailed in chapters 6 (*Drivers*) and 7 (*Owners*), leads to the important question of how to combine these two perspectives into an overall understanding of what interventions are most supported. Only data from Assoc A and Assoc B are included here as they comprise the primary focus and both driver and owner data were collected for both. However, there are important additional criteria such as cost to consider as well; to account for these, a multi-criteria analysis was chosen. The following criteria were included:

- Driver acceptability
- Owner acceptability
- Cost to TDA
- Transition difficulty
- CFC system
- TDA payment administration
- Complementarity issues addressed

Inclusion of the industry perspective is critical considering the resistance to MyCiTi implementation in Phase 1 (Schalekamp & McLachlan, 2016). The operational cost to TDA and transition difficulty are key criteria again stemming from the experience with Phase 1; the two most critical lessons learned are that BRT operational costs are unsustainable and the transition from paratransit associations of individual operators to formalized corporatized operating companies proved expensive and time-consuming. Reducing costs and ensuring more efficient transitions to an improved quality of service are beneficial both to passengers and TDA.

As described in chapter 9 (*Discussion*), CFC systems have proven difficult to implement in many reform attempts including the TOC pilot undertaken in Cape Town and within SACCOs and transport management companies in Nairobi. A considerable number of other CFC implementation attempts in paratransit have failed elsewhere on the African continent (Tinka & Behrens, 2019). In addition, discussion by owners in focus groups indicated that City-monitored CFC was more problematic than City-monitored tracking devices (chapter 7 *Owners*). These examples suggest that CFC is a large barrier and may create issues when included in particular interventions. The criterion attempts to consider this.

The payment administration criterion references the added burden to TDA around paying incentives or administering a contract compared to the status quo where effort is limited to OL regulation for MBT operators. Monitoring data from trackers and/or CFC systems and making payments to operators accordingly will add time and cost to the interventions and these were not considered in the cost estimates so are included here.

The last criterion considers passenger quality of service. As discussed in chapter 3 (*Research Context*), two service quality issues have been documented in Mitchells Plain, namely service span mismatch and long off peak headways. Interventions that address both of these issues provide greater benefit than those that simply extend service without any effect on headways.

Weights for criteria were determined through the analytic hierarchy process developed by Saaty (1980). This involved making pairwise comparisons of all criteria and selecting the degree to which one criterion is more or less important than the other. Once all criteria are compared this way, the consistency of responses is compared to ensure that all comparisons generally align. If inconsistency is high, comparisons are revisited and adjusted until a reasonable level of consistency is achieved. This process can be done with multiple individuals, but in this case I elicited weights only from myself.

I used a free trial version of Transparent Choice, a web-based AHP tool (*TransparentChoice*, n.d.). After entering the seven criteria, the software determined all possible pairwise comparisons and for each I determined whether the two criteria were equally important, or if one was more important on a scale of one to nine. At the conclusion of my choices, inconsistency was calculated as 3.8 percent, an acceptable level. Weights are shown in Table 52. The industry perspective is most important, with Owners somewhat more so because they have legal recognition as OL holders. Cost, transition difficulty, and complementarity issues are equal which aligns with the desire for the best possible quality of service at the least cost, both in terms of ongoing operations and generalized cost of transition. Payment administration and CFC are relatively less important though are important to consider.

All criteria were scored on a common scale of zero to 100, with zero indicating the best performance and 100 the worst. Continuous values for driver and owner acceptability (from chapters 6 *Drivers* and 7 *Owners*) and cost (*8.1.2 Estimation results*) were normalized proportionally to this scale. Categorical scales were each unique and scores and definitions are shown in Table 51.

Table 51. Scores and associated definitions for categorical criteria.

Criteria	Score	Definition
Transition difficulty	0	No TDA involvement in transition of operations, operator structure, or licensing.
	33	Involvement to transition operations only.
	66	Involvement to transition operations and licensing.
	100	Involvement to transition operations, licensing, and operator structure (formalization).
CFC system	0	None
	50	MBT-only system
	100	Intermodal system
TDA payment administration	0	No
	100	Yes
Complementarity issues addressed	0	Span and headway
	100	Span only

Scores for all criteria are shown in Table 52. Because group and aggregated individual owner acceptability results aligned, the aggregated individual data is used for scoring this criterion. For Transition difficulty, both Rank security and Higher evening fare received a score of zero as these do not involve any changes to status quo operational structure. Three interventions (Transfer bonus, Headway bonus, and Operating deficit payment) received a score of 33 because they retain much of the current operational structure as individual owners and drivers with some changes related to technology and subsequent inducements via incentives. E-hailing requires a larger shift, leaving behind routes and fill-and-go and moves to some degree of collective operations as controlled by the app routing and matching technology. The most dramatic shift from the status quo comes with Off peak contract and as a result gets a score of 100.

Three interventions require CFC (Transfer bonus, Operating deficit payment, and Off peak contract), but only Transfer bonus requires that system to be intermodal to accurately count the number of passengers that qualify for bonus payments to drivers because they transferred from another mode at the PTI. The other two interventions do not need to be intermodal and become easier to implement simply because it does not require coordination across multiple agencies and operators to implement an interoperable system. Certainly this is a long term goal for any integrated transport system, but CFC does appear to be a barrier and this must be considered when comparing these interventions. The E-hailing intervention does include options for cashless payment (cash remains an option), but because this is contained within the app, there is no additional effort required.

TDA payment administration would be needed for Off peak contract within a contract management structure, but also for the three interventions that involve incentive payments (Transfer bonus, Headway bonus, and Operating deficit payment).

Rank security, Higher evening fare, and Transfer bonus will likely extend services, but will not address the issue of potentially long headways. These interventions receive a score of 100. Headway bonus and Off peak contract explicitly encourage or require short headways. E-hailing will likely reduce wait times for passengers by adjusting routing to boarding requests rather than waiting for vans to fill at the rank and Operating deficit payment may encourage vans to leave the rank with fewer passengers because drivers are guaranteed a small profit regardless of passenger count.

8.2.2 Acceptability

Rank security is the most feasible intervention (Table 53). This aligns with results from the initial focus group (chapter 6 *Drivers*) as well as repeated unstructured interactions with both owners and drivers over the course of the research. This intervention does not require change from status quo

operations, so there is little change to resist. In Figure 42, Rank security (A) appears at the top right corner, indicating its high acceptability to both owners and drivers; the intervention is somewhat more acceptable to owners as evidenced by the position above the diagonal line indicating equal acceptability from both perspectives.

Table 52. Multi-criteria analysis scoring.

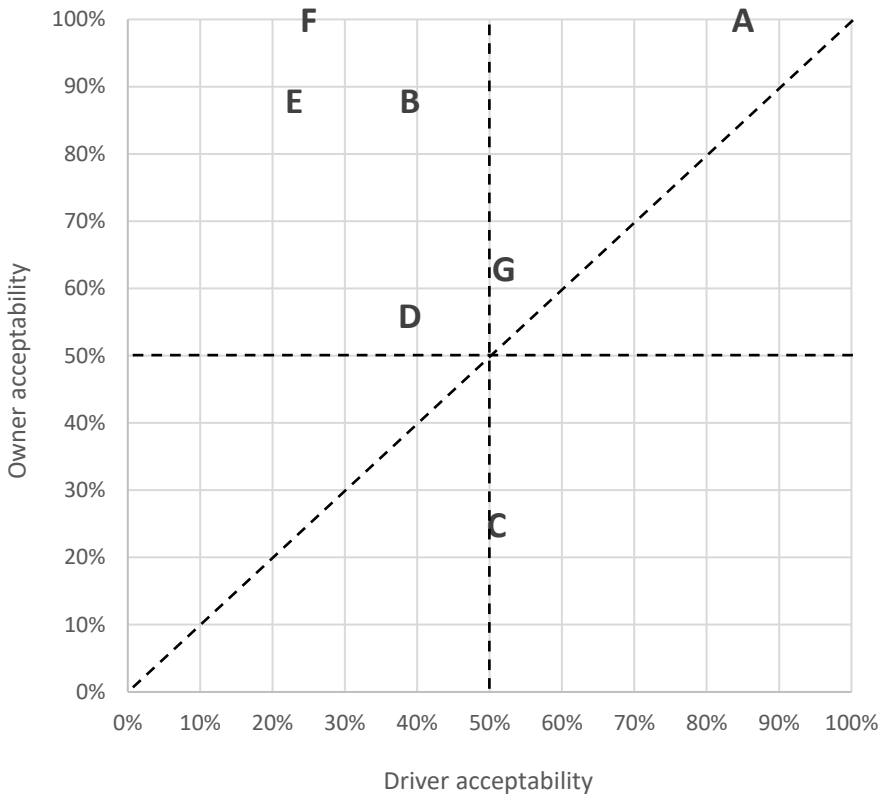
Criteria	Weight	Rank security	Transfer bonus	Headway bonus	Op. deficit payment	E-hailing	Off peak contract	Higher evening fare
Driver acceptability	25%	0	59	45	59	100	92	44
Owner acceptability	31%	0	28	100	45	28	0	40
Cost to TDA	13%	16	34	43	37	18	100	0
Transition difficulty	13%	0	33	33	33	66	100	0
CFC system	2%	0	100	0	50	0	50	0
TDA payment administration	3%	0	100	100	100	0	100	0
Complementarity issues addressed	13%	100	100	0	0	0	0	100
Unweighted score		14.45	56.76	40.16	40.42	26.55	55.25	22.99
Weighted score		15.03	50.22	55.18	41.64	44.72	53.00	36.36

Table 53. Multi-criteria analysis results.

Intervention	Unweighted	Weighted	Weighted rank	Driver rank	Owner rank
Rank security	14.45	15.03	1	1	1
Higher evening fare	22.99	36.36	2	2	3
Operating deficit payment	40.42	41.64	3	4	4
E-hailing	26.55	44.72	4	6	2
Transfer bonus	56.76	50.22	5	4	2
Off peak contract	55.25	53.00	6	5	1
Headway bonus	40.16	55.18	7	3	5

Similarly, the second most feasible intervention Higher evening fare does not require any changes to the status quo. This is less acceptable than Rank security partly because of concerns over passenger willingness to pay increased fares. A few drivers and a number of owners expressed this; owner focus groups were split over this issue. Some owners felt that passengers would expect to be dropped at their door rather than along the route if a higher fare was charged; this would increase safety of passengers who would no longer have to walk. Only when looking at the owner perspective does Higher evening fare not place second.

Figure 42. Owner and driver acceptability plotted.



Notes:
– A: Rank security, B: Transfer bonus, C: Headway bonus, D: Operating deficit payment, E: E-hailing, F: Off peak contract, G: Higher evening fare.

An interesting result here is that Transfer bonus and Operating deficit payment, which require a higher level of monitoring through the CFC system, are seemingly more feasible than Headway bonus which requires monitoring only via a tracking device. Headway bonus appears to be the least feasible intervention, partly due to the strong feelings of owners; the main concern about this intervention was the increased maintenance costs that would arise from additional trips in the evening. Without some financial benefit to them, there was major resistance because of the large number of trips that would be encouraged under this intervention over and above resistance along these same lines for other interventions. Looking at Figure 42, it seems obvious that Headway bonus is least feasible according to the multi-criteria analysis as it is the only intervention in the bottom half and is only barely outside of the lower left quadrant.

E-hailing would require a shift to area licensing; 67 percent of drivers responded that they could make more money in other areas if licensing allowed, suggesting that a majority would be amenable to a shift in licensing. Owners were generally amenable to this change as well, though some expected enforcement to be stricter. Neither stakeholder group was concerned about vehicles being shown on

passenger apps; one owner from Assoc A stated that gangsters and criminals do not need an app to rob you because they can simply wait on the road as they do now. Other owners recognized the potential to reduce wait time and one saw this shift as "the future."

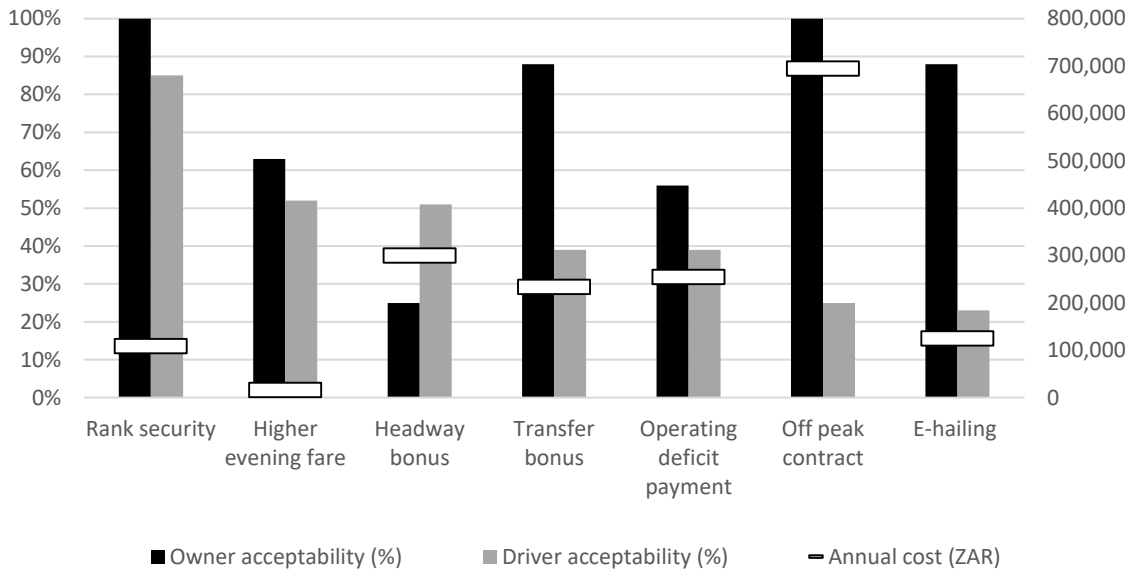
Transfer bonus did not elicit major discussion among drivers regarding the intervention overall, but resistance to drivers being paid directly and the lack of benefit for owners were present for this intervention as they were for most others.

Off peak contract does not score much better than Headway bonus. Both interventions would address both service span and headway complementarity issues. Off peak contract is unanimously favored by owners, but supported by only a quarter of drivers. Despite the heavier weighting for the owner perspective, the driver perspective and other factors, including transition difficulty and cost, reduce this intervention's score. Both Off peak contract and E-hailing involve rather large changes from the status quo, though more so for Off peak contract. However, the industry does have concrete examples of the Off peak contract intervention in MyCiTi Phase 1 and the TOC pilot while E-hailing for MBTs remains theoretical and unproven, making the concept more difficult to understand and more uncertain. Resistance to the corporatization approach in Phase 1 was due to similar uncertainty.

Ignoring all criteria except for driver and owner perspectives (Figure 42), Higher evening fare (G) seems to be relatively unacceptable. But there is something to be said for undertaking a reform that is lower in acceptability yet high in agreement (gap of 11 percent) between drivers and owners because it will avoid tension within the association. This may also apply to Rank security (A) and Operating deficit payment (D). In contrast, there is a large gap in agreement with Off peak contract (F) of 75 percent.

Figure 43 shows driver and owner acceptability with intervention costs. While the multi-criteria analysis includes all three, this chart provides another way to look at the data.

Figure 43. Comparison of owner and driver acceptability with intervention cost.



As discussed in chapter 6 (*Drivers*), one of the few subcomponents of the interventions that can be adjusted is the obligation for drivers to pay tax; the other subcomponents like tracking devices are required for the intervention to function as intended. Providing a tax exemption for drivers would increase the acceptability of all interventions except Rank security and Higher evening fare (because drivers can continue to underreport cash earnings). Because the majority of owners are willing to pay taxes (chapter 7 *Owners*), a tax exemption does not impact owner acceptability. To consider this potential policy tool, the multi-criteria analysis was repeated for increased driver acceptability stemming from a tax exemption. All other input data remain the same (Table 54). Results are shown in Table 55.

Table 54. Multi-criteria analysis scoring for tax exemption scenario.

Criteria	Weight	Rank security	Transfer bonus	Headway bonus	Op. deficit payment	E-hailing	Off peak contract	Higher evening fare
Driver acceptability	25%	0	40	40	44	100	68	31
Owner acceptability	31%	0	28	100	45	28	0	40
Cost to TDA	13%	16	34	43	37	18	100	0
Transition difficulty	13%	0	33	33	33	66	100	0
CFC system	2%	0	100	0	50	0	50	0
TDA payment administration	3%	0	100	100	100	0	100	0
Complementarity issues addressed	13%	100	100	0	0	0	0	100
Unweighted score		14.45	54.34	39.48	38.57	26.55	52.21	21.29
Weighted score		15.03	45.39	53.82	37.96	44.72	46.91	32.97

Table 55. Multi-criteria analysis results for tax exemption scenario.

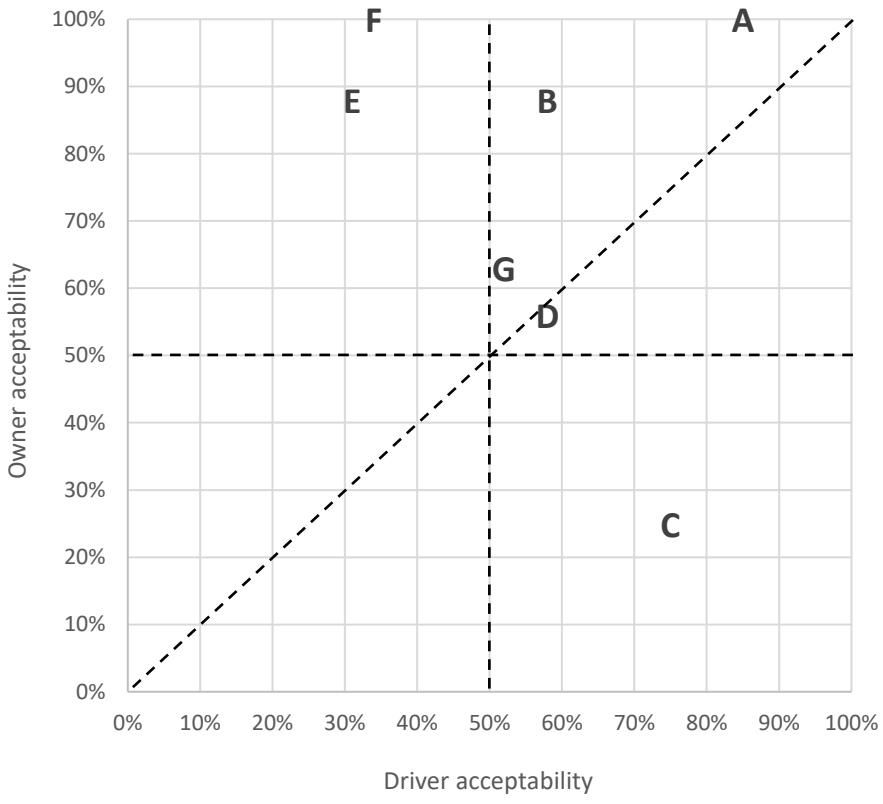
Intervention	Unweighted	Weighted	Weighted rank	Driver rank	Owner rank
Rank security	14.45	15.03	1	1	1
Higher evening fare	21.29	32.97	2	4	3
Operating deficit payment	38.57	37.96	3	3	4
E-hailing	26.55	44.72	4	6	2
Transfer bonus	54.34	45.39	5	3	2
Off peak contract	52.21	46.91	6	5	1
Headway bonus	39.48	53.82	7	2	5

Overall results in terms of weighted score and rank do not change from the analysis assuming tax obligation and Rank security and E-hailing scores stay the same. All other intervention scores improve in weighted score, but not enough to change the overall ranking.

Headway bonus (C) improves considerably in driver acceptability which results in a major move away from agreement with owners, almost doubling the agreement gap (Figure 44). Operating deficit payment (D) increases in acceptability and moves over the 50 percent threshold; in this case, the agreement gap closes to only 2 percent. The largest agreement gap is again Off peak contract (F) at 66 percent, though this is smaller than 75 percent assuming tax obligation. Transfer bonus (B) also moves over 50 percent for drivers, but still demonstrates a relatively large gap of 30 percent with owners.

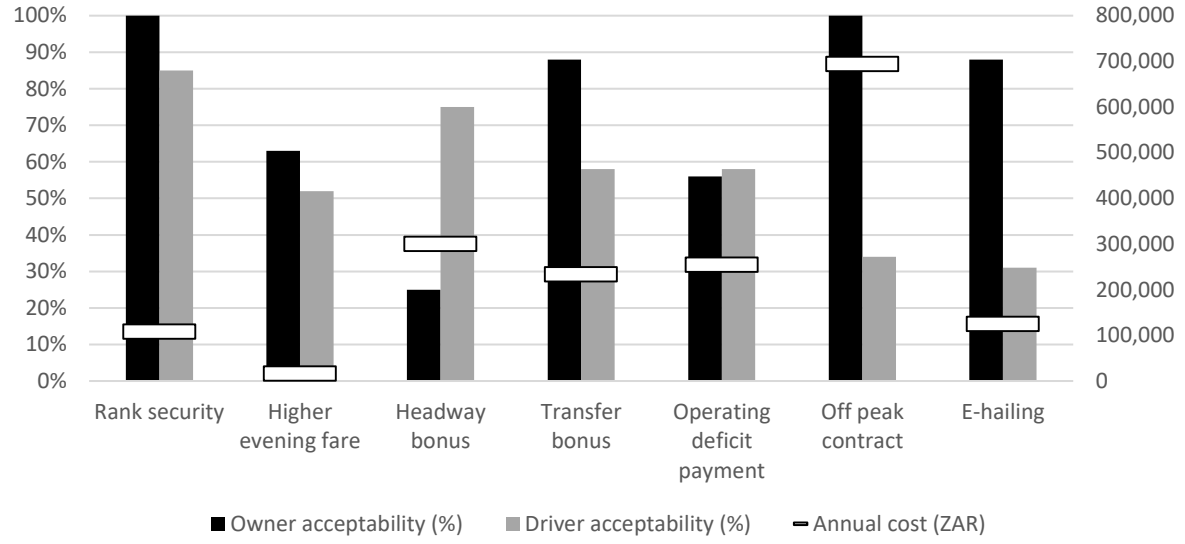
During the focus groups, an owner from Assoc A suggested MBT operators should at least be subject to a lower tax rate in recognition that the industry is "doing government's job" by providing PT services. Realizing that negotiating this lower rate or a full exemption requires involvement of SARS, this policy tool may be ambitious, especially considering it has almost no impact on overall feasibility of interventions according to the multi-criteria analysis. However, it may be effective in increasing acceptability and willingness among drivers to participate in these interventions, an important element considering that owners appear more willing in general.

Figure 44. Owner and driver acceptability plotted for tax exemption scenario.



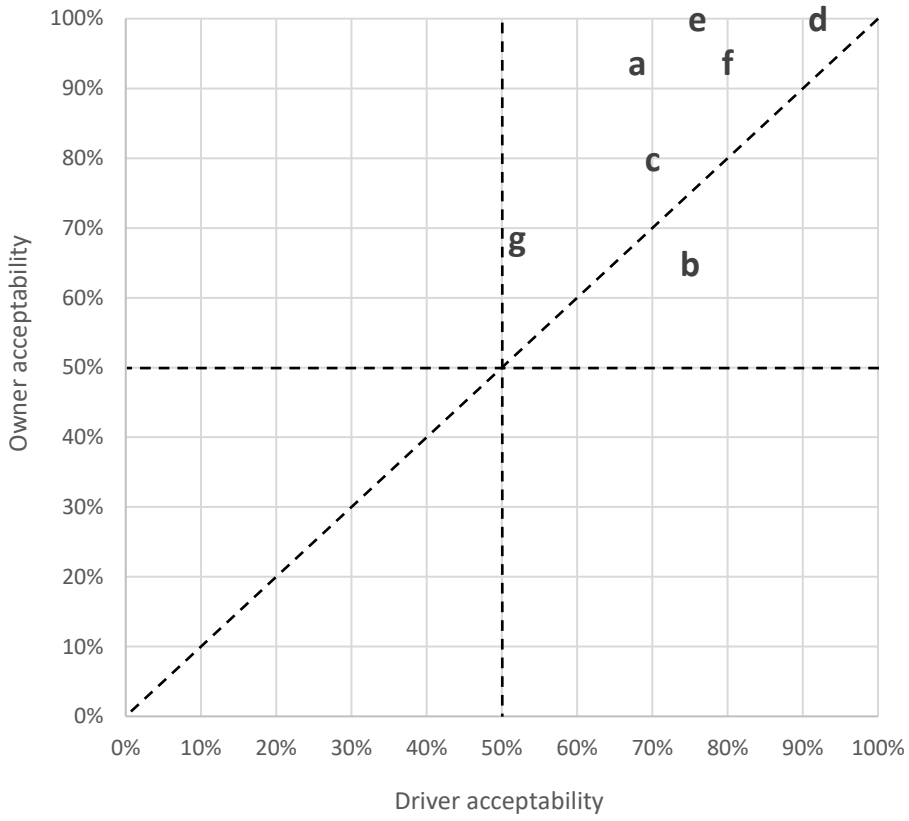
Notes:
– A: Rank security, B: Transfer bonus, C: Headway bonus, D: Operating deficit payment, E: E-hailing, F: Off peak contract, G: Higher evening fare.

Figure 45. Comparison of owner and driver acceptability with intervention cost for tax exemption scenario.



In addition to comparing driver and owner acceptability at the intervention level, some ability to compare perspectives on the subcomponent level is possible because certain survey and focus group questions were roughly parallel. However, it should be noted that these questions were not worded identically and therefore this comparison is only indicative. Figure 46 shows there is relatively high levels of acceptability for these seven indicators. Owners are more accepting than drivers for all but one indicator, with drivers more accepting of tracking devices (b). There are also relatively high levels of agreement; the largest gap, for paying tax (a), is 26 percent, a much smaller gap than seen at the intervention level. The smallest gap, or where the two stakeholders most agree, is for the need to reduce vehicle counts (d, 8 percent gap). There is a tension between the high levels of agreement for reducing vehicle count and the high proportion of both drivers and owners who depend on their MBT work as their sole source of income, which is 96 percent and 94.7 percent respectively. This suggests that everyone is interested in seeing other drivers/owners leave the system so they can benefit from reduced competition.

Figure 46. Driver and owner acceptability of subcomponents plotted.



Notes:
– a: Paying tax, b: Use of tracking device, c: Use of monitored CFC, d: Should reduce vehicle count, e: Should form a company, f: Acceptable if van location is visible on app, g: Evening fares should be increased.

8.3 Summary

The top three most feasible interventions, in order, are Rank security, Higher evening fare, and Operating deficit payment. The first two require the least amount of change from the status quo and the least involvement, especially in monitoring, from government. It is interesting then that Operating deficit payment places third because it involves a considerable increase in government monitoring and involvement. However, it does trend towards the idea of subsidy by ensuring all operating costs are paid for and ensuring a small profit for drivers; calls for subsidy in one form or another has been a common refrain from the MBT industry in general and these two associations are no exception (more to be discussed in chapter 9 *Discussion*). Owners were resistant because of the lack of support to them for increased maintenance costs, but this resistance was not as high compared to Headway bonus.

Drivers are less accepting of increased evening fares compared to owners, likely because they know they will take the brunt of passenger complaints.

Despite strong acceptability from owners, Off peak contract placed second last. Driver acceptability was low, and this intervention suffers from a number of barriers surrounding transition and cost. It is somewhat surprising Headway bonus scored worst, but owners were very resistant to the increased maintenance costs for this intervention in particular.

The top three interventions are also those for which drivers and owners have the highest level of agreement. This suggests that these interventions, in addition to being overall most feasible, also are least likely to cause tension in the association between stakeholders. Ideally this results in smoother implementation.

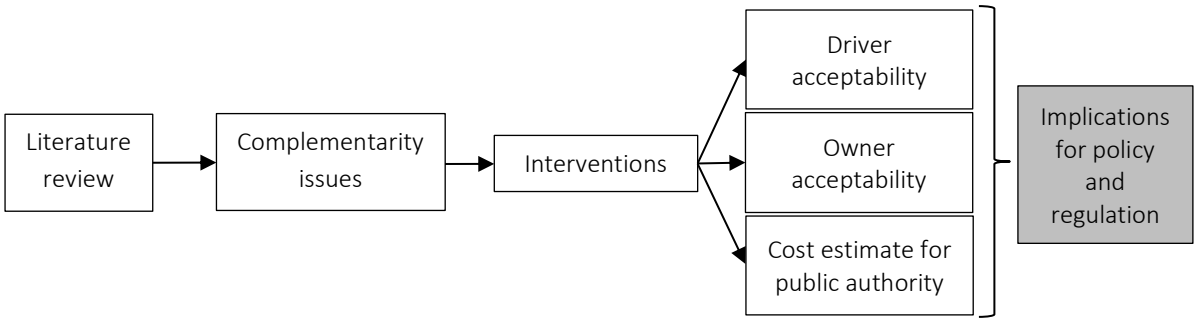
Operating deficit payment is the most expensive of the top three interventions, with Rank security roughly half the cost. Higher evening fare costs the City nothing though increasing fares for passengers may be a problematic policy to support.

Regarding the complementarity issues, Operating deficit payment has the benefit of addressing headways to some extent unlike the other top two. This is important when passenger demand is expected to be low. Interestingly, the two interventions that most explicitly address the issue of long off peak headways ended up in the bottom positions (Off peak contract and Headway bonus).

From the analysis above, providing a tax exemption for owners is not worthwhile and providing the same for drivers does not change overall results although it does push the driver acceptability of Operating deficit payment above 50 percent and closes the agreement gap with owners to only two percent.

This chapter has provided cost estimates for each intervention and then combined those estimates with driver and owner acceptability from the previous chapters (chapters 6 *Drivers*, 7 *Owners*) with additional considerations to provide an indication of which interventions are most feasible to implement to address the issues of service span mismatch and long off peak headways when unscheduled MBT services and scheduled PT trunk services meet at the Mitchells Plain PTI. These results are discussed within the broader context of paratransit reform in the next chapter, 9 *Discussion*, and in relation to other relevant research to discuss policy implications.

9 Discussion



There is an ongoing debate around the future of paratransit in many cities in low and middle income countries and South African cities are no exception. Many cities have, in the recent past, attempted to eliminate paratransit and implement BRT as a replacement. This has been more difficult and expensive than originally expected in most cities and in Cape Town in particular; time and cost to transition individual operators into corporatized entities capable of providing contracted, scheduled services has proven too great and ongoing operational costs are high and increasing, putting a strain on limited government budgets. The impasse in late 2019 over renegotiation of the N2 Express MyCiTi operations contract indicates that issues associated with transition are not laid to rest once the initial 12 year contracts are concluded and may well continue to stymie efforts to improve PT (Somdyala, 2019).

Considering this state of affairs, some have begun to consider alternative approaches to paratransit reform as discussed in chapter 2 (*Literature Review*). Some of these alternative approaches have been attempted in other cities in low and middle income countries (discussed in chapter 2 *Literature Review* and chapter 5 *Interventions*) and it is useful to draw lessons for future efforts at paratransit reform in South Africa. However, each context is unique, and it is important to consider the particular context of South Africa and Cape Town which this research does. This research is particularly relevant because the City has expressly indicated a shift in approach to paratransit/PT reform which does not seek to systematically eliminate all paratransit operators and rather seeks to have scheduled and unscheduled modes operating in concert. This has been termed the hybrid network. Findings are intended to provide some guidance to government as this hybrid network is designed, specifically from the perspective of a portion of the MBT industry in Cape Town. Because of resistance to the reform efforts in Phase 1 of MyCiTi implementation, this information is important to consider moving forward (Schalekamp & McLachlan, 2016).

The summary of the previous chapter (*7.2.4 Summary*) highlighted the key findings of this research—the overall feasibility of reform packages based on the industry's perspective—but this chapter goes into details and discusses the wider implications for policy and implementation of PT reforms.

9.1 Most feasible interventions

Considering the experience with Phase 1 of MyCiTi implementation, it could be expected that the interventions that require the least change from the status quo for MBT operators, the least cost for government, and the lowest need for capacity-building among MBT operators (and capability for government to support it) will be deemed most feasible in this research. Findings align with these expectations.

A key conclusion of this research is that implementing scheduled, contracted BRT feeder service appears to be less viable compared to the other interventions explored. The Off peak contract intervention scored sixth of seven interventions, aligning with previous research documenting industry resistance to such a reform in Phase 1 and from the issues experienced with MyCiTi implementation more generally as discussed briefly above.

In contrast, the three most feasible interventions appear to be Rank security, followed by Higher evening fare, followed by Operating deficit payment. Increased security at the rank was a theme repeated throughout the research, from initial engagement and the SC survey design focus group through later engagement with owners. This, coupled with the lack of changes required in the status quo for owners and drivers, means this is not a surprising result. This intervention would require little effort on the part of the City though coordination with SAPS may be a small barrier considering the somewhat lengthy negotiations required to implement a special rail security unit in Cape Town. However, as discussed in chapter 6 (*Drivers*), the Rank security intervention alone is unlikely to produce a high probability of drivers agreeing to provide additional evening trips. This intervention would most likely need to be combined with another such as Higher evening fare that increases driver earnings. Costs of each intervention combined with Rank security, the cost of a SAPS officer, can be found in chapter 8 (*Implementation Feasibility*) in Table 50.

Higher evening fare is the second most feasible intervention. While the purpose of this research is to provide insight into how to improve quality of service for passengers, it did not explicitly consider the passenger perspective outside of the assumption that passengers would prefer to have additional service provided to match scheduled services at the PTI and for that additional service to be frequent. The fact that Higher evening fare is the second most feasible intervention highlights issues of affordability for passengers; in Cape Town, many passengers already spend large proportions of their

income on PT fares and any reform that increases this amount is problematic both in actuality and politically. It may be difficult for the City to support such an effort, though associations would be able to make this change without City involvement. Some experts consulted through the intervention design suggested this reform goes against standard fare policy to promote peak spreading, but the period of this higher fare would begin late enough (at seven pm) to avoid any negative impact on peak travel decisions.

Owners in Mitchells Plain were divided on this intervention; some were concerned about passenger ability to pay. Others expected that if passengers were charged a higher fare for an evening trip, passengers would demand to be dropped at their door rather than along the route as is typically the case. If drivers and passengers agreed to this arrangement, passenger security would improve considerably by essentially eliminating walking at night. By providing this rank-to-door service, the potential evening service would mimic "house calls" currently provided by drivers at other times of the day where passengers pay a premium to be dropped at home. This is sometimes used by older passengers or those with groceries.

Because the Higher evening fare intervention requires no government involvement for implementation, why has neither association in MP tried this? Assoc A owners were unwilling to support this intervention, but for Assoc B this may indicate a collective action problem; perhaps despite a majority of owners being willing to support this intervention, no one has decided to lead implementation.

The third most feasible intervention is Operating deficit payment which marks a major shift from the first two in that it involves a much higher level of City monitoring of operations and includes direct payments to drivers. This intervention moves decidedly in the direction of an off peak supply side subsidy, though without new vehicles and all-day subsidy involved in a fully contracted feeder aligned with the approach used in Phase 1 of MyCiTi. Calls for subsidy have been made by the MBT industry for years, possibly making this intervention mutually beneficial as drivers receive incentives for operating, ensuring that all trips result in positive earnings, while the City obtains operations data that can be used for future planning. If both parties can uphold the agreement, passengers benefit from improved service in the short term but possibly the most important benefit is the trust that would be built between operators and government that could grow into further reforms in the medium term. Overall, there is promise with the intervention as drivers and owners indicated similar levels of acceptability and cost to government is reasonable in comparison to others. It also has the benefit of addressing both quality of service issues, though the effect on headways may be less robust than under the Headway bonus for example. One owner from outside Mitchells Plain suggested

independently that MBTs should receive off peak subsidies, but that peak services could be left to operate as normal because they can do so profitably during peak periods. There may be potential for these same interventions to be used at other off peak periods where government is interested in obtaining improved services.

9.2 Implications for incentivized interventions

Of the top three interventions, only Operating deficit payment involves incentive payments from the city. This section discusses operator perspectives and logistical challenges involved with implementing such incentivized interventions. Discussion here applies to all interventions involving incentives, though is most relevant to Operating deficit payment because it is highly feasible.

Owners were most often resistant to two indicators: letting drivers keep all bonus money from evening trips and allowing drivers to be paid incentives directly by the city. Owners made clear that because they are the business owner, they should be in control of the finances of that business. Despite admission that this is not the case currently because drivers control fare revenue and owners have little insight into the financials of the business, having this control is a strong desire among owners. The idea of having the City pay drivers directly was not popular because it continued to give drivers control. While this impasse could easily be resolved if the City paid incentives to owners to then pass through to drivers, it creates another issue highlighted in chapter 5 (*Interventions*) from Jakarta where incentives were paid this way. Drivers did not trust owners to pay them the appropriate incentive and the program failed. Interventions for this research were designed to avoid this issue, but this uncovered owner resistance to being cut out of the process.

Owners felt they should benefit from incentives as well, primarily because additional evening trips would result in greater wear and tear on vehicles and eventually in increased maintenance costs. If an incentivized intervention were to be implemented that included only driver payments, owners would, depending on association, likely increase the daily target amount or calculate commission including these incentives to cover these maintenance costs. This means that the incentive for drivers to provide additional evening trips would be weakened; either the additional trips would not be taken as hoped, or the City would have to pay higher incentives to restore the original buying power of the incentive. If larger incentives were paid, the cost of certain interventions (Transfer bonus, Headway bonus, Operating deficit payment, and Higher evening fare) would increase accordingly as discussed in *8.1.2 Estimation results*.

Assoc A owners were more accepting of drivers keeping money earned on additional evening trips when no City incentives were involved partly because owners recognized that additional work by

drivers should be rewarded with higher earnings than during normal hours. However, when incentives were involved, owners felt they should also benefit. This approach, where both owners and drivers receive incentives, appears to be the approach used in eThekwini under the Moja Cruise program. This research indicates the need for both stakeholders to benefit financially which may have been discovered through the planning process for Moja Cruise. It also aligns with the suggestion by Jennings et al. (2016) that "strategies aimed at improving the profits and income security of owners have the greatest prospect of success."

Owners were particularly resistant to drivers keeping all additional earnings for Headway bonus because this intervention would encourage more additional evening trips than others, increasing maintenance costs more as well. By factoring in incentives for owners for this intervention, government could reduce resistance and possibly increase the feasibility of Headway bonus.

There are a number of logistical items related to incentivized interventions that would need to be worked out prior to implementation. One issue is temporal; drivers will provide additional trips yet not receive incentives for that service until days or possibly weeks later depending on the city's payment schedule. Drivers would need to trust this payment would indeed come and that it would be correct. Some sort of verification system would likely reduce concerns among drivers. For interventions involving CFC, a printout from the fare validator per trip or per day listing the passengers carried, incentives earned, and other information would allow drivers to verify incentives received. If incentives were designed to be paid through owners as discussed above, the City could send SMSs to drivers at intervals indicating how much they should be paid from owners as a way to counteract the incentive for owners to underpay. These verification systems might increase the cost of interventions, though would reduce tension and mistrust and likely be worthwhile investments as key resistance in the industry stems from historical and current mistrust of government intentions (Schalekamp & McLachlan, 2016). One interesting challenge Assoc A owners highlighted was the potential for an owner to have multiple drivers over the course of a short period of time. This would complicate the City paying incentives because each driver would need to be paid separately. In this case, it might be easier to pay owners and let them distribute payments accordingly. Such details would need to be addressed for an incentivized intervention to succeed.

The actual system for paying incentives is not prescribed in this research. However, the City is developing an operating license administration system (OLAS) that will more effectively manage MBT operating licenses and also allow online payments for new applications and renewals (Van den Berg, 2019). While current plans do not include the ability to link drivers to operating licenses, it is possible this system could be adapted to also contain records of drivers and enable incentive payments to

those drivers. The benefit of a comprehensive system is that it allows verification of operating license validity and could be used to restrict incentive payments only to drivers who are properly qualified and associated to a legally operating vehicle. Providing this carrot of incentives only to legal operators may encourage illegal operators to apply for licenses and may decrease the enforcement costs associated with vehicle impoundments both for government and for operators. The effectiveness of impoundments is also debatable, with many owners willing to pay high release fines only to continue operating illegally.

Interestingly, Assoc A owners suggested it was unlikely that the City would pay incentives to the MBT industry outside of the Off peak contract intervention. In other words, the only way that government financial support would be forthcoming is through a formalized and corporatized structure. This may be due to their exposure to City officials and representatives contracted to implement the TOC pilot or could be from observing MyCiTi Phase 1 where existing paratransit operators were supported with contracts to operate new services under newly formed companies. Regardless, this is an interesting perspective.

Another point of resistance among owners for incentivized interventions was City monitoring of CFC and vehicle trackers, though there was agreement that such monitoring would be acceptable if owners received incentives from the city. While owners recognize the inherent benefits of CFC and tracking for them—CFC gives owners control over revenue and tracking provides insight into driver behavior and increases security—these benefits were not enough to outweigh the disbenefits of City monitoring. During discussion of the Operating deficit payment intervention, Assoc B owners indicated that the City must be willing to pay a subsidy in exchange for monitoring these devices. This extended even to the app used in the E-hailing intervention because no direct incentives would be paid; this despite the fact that the City would be providing the app for free. Overall, owners were agreeable to the minimum level of monitoring necessary to receive incentives. For example, CFC monitoring was resisted by Assoc A for all interventions that included it except for Transfer bonus, which relies on the CFC system to quantify the number of transferring passengers and therefore the incentive to be paid.

The City plans to use RFID tags to monitor MBT vehicle operation in real time once the licensing and regulatory functions are transferred from the province (Van den Berg, 2019), but the findings of this research suggest the City will face resistance to this effort. These findings align with Jennings et al. (2016) who highlight likely resistance to government monitoring of operators and that a key mechanism for decreasing such resistance is to increase operator income.

While a carrot approach may be more effective, government could also use the stick approach of requiring all MBT vehicles receiving recapitalization funds to have tracking devices open to City monitoring. This would slowly increase the enforcement and planning capabilities of local officials. A small-scale trial of an automatic vehicle location-like system was undertaken in Cape Town in 2007 and City officials found the data useful for route compliance monitoring (Van Zyl & Labuschagne, 2008).

Monitoring of CFC systems was more unpopular than monitoring of tracking devices. The owner from Assoc D suggested that drivers would circumvent the CFC system by taking cash fares so they could avoid having this revenue visible to the owner and then keep it for themselves. This suggests that while CFC is often seen as a critical way to address a number of problems in MBT operations, there are human-related implementation challenges that will arise and must be addressed. Another of these factors is the relative satisfaction and importance of cash fare payment to passengers in Mitchells Plain likely because many are lower income and would rather keep limited finances flexible than lock money way on a smart card. This means that two key stakeholders are likely to resist CFC while government and owners are in favor. Similar to the temporal disconnect between drivers providing service and being paid the appropriate incentive, CFC will change the timing of payment to both drivers and owners. Drivers will no longer receive cash as passengers pay, hindering their ability to pay for fuel for the day's operations and owners will no longer receive target or commission pay as frequently as CFC will likely move to weekly or biweekly payouts. While 76 percent of drivers prefer to be paid weekly if they were paid a salary, it remains to be seen how this change might impact the ecosystem.

The issues highlighted above suggest CFC implementation is a challenge and this conclusion is supported by experiences elsewhere on the continent where all attempts to implement CFC on mini- or midi-buses have failed to go beyond the pilot phase, with one known exception being Gona in Lagos that appears to still be operational (Tinka & Behrens, 2019). Transport management companies in Nairobi, as discussed in chapter 2 (*Literature Review*), have also attempted to implement CFC across their franchised vehicles but no system has been successful. In Cape Town, the TOC pilot was originally intended to include CFC as scheduled services were implemented, yet this was deemed too difficult and expensive to undertake for a pilot. All of these examples indicate implementation of CFC is a major barrier. However, it is possible that CFC is not as critical as often stated if drivers can be shifted to salaries without it. One of the key drivers of aggressive driving, fill-and-go loading, and other negative characteristics of paratransit services is the pressure felt by drivers to earn targets for owners and take-home pay for themselves; by removing this incentive by paying drivers set salaries

per day, many of these characteristics are theorized to disappear. Therefore it seems salaries are the key goal, while CFC is merely a means to that end. If the end can be achieved without CFC, then reform efforts appear to have a greater chance of success.

The coexistence of driver salaries and cash fares occurs with TMCs in Nairobi though drivers also earn via a revenue-based incentive that on average makes up 24 percent of pay. Cash fares are tracked through a system of paper tickets that gives the company greater insight into fare revenue. The company does not have full control over revenue, which is the main drawback, but an improved version of this system may be a more viable solution than a fully cashless system. A similar arrangement was introduced for AFTU buses in Dakar that were part of a recapitalization program that included reorganization of operators into economic interest groups. Paper tickets provide some record of fare revenue and the change has increased owner revenue, though opportunity still exists for crew fraud (Kumar & Diou, 2010).

While an alternative system to CFC may be appropriate in some cases, for the purposes of the Operating deficit payment intervention CFC plays an important role in protecting the City against fraudulent claims by the industry regarding incentives. At the very least, current regulations mandating EMV CFC systems in South Africa should be reviewed with the goal of making CFC systems more flexible and affordable to enable cities to capitalize on new technologies (Schalekamp et al., 2017).

9.3 Implementation risk

9.3.1 General

While all interventions except Headway bonus were acceptable to over 50 percent of owners, acceptability among drivers was lower; only three interventions garnered support from a majority of drivers: Rank security, Higher evening fare, and Headway bonus. Rank security and Higher evening fare were the top two most feasible interventions overall and both have the support of a majority of both stakeholders. On the other hand, Operating deficit payment has only 39 percent of drivers indicating acceptability suggesting that there is some risk in implementing this intervention due to resistance from the remaining drivers who make up a majority of the surveyed population. This despite the fact that Operating deficit payment was third most feasible. One way to address this issue is to follow the planned approach of Moja Cruise where program participation is voluntary. As with any change, drivers and owners are likely to be somewhat hesitant and allowing those who are willing to accept the change as early adopters to do so voluntarily allows the concept to be proven. Over

time, those unwilling to accept the change at first are likely to be convinced once the new system is working.

Despite the apparent promise of interventions that do not involve corporatization and formalization, there is a risk that maintaining MBTs as un-collectivized individual operators may eventually lead to issues. One example can be seen with the decline in rail services. MBT operators who previously provided feeder services to major PTIs are finding that passenger demand to the PTI has declined along with rail services and passengers request drivers to take them to their final destinations instead. Drivers do this at their own risk of being caught off-route by enforcement officers, but associations operating in other areas have noted an increase in the number of out-of-area vehicles. It may be difficult to return to previous operations when rail eventually does improve. The City could face a similar situation if MyCiTi trunk services decline in service quality or are temporarily shut down as was the case during N2 Express contract re-negotiations.

However, it is clear from Phase 1 and from other cities in South Africa that have attempted to implement BRT that there are major concerns with the full replacement approach. The Public Transport Strategy suggested that all PT reforms would be complete by 2020 (National Department of Transport, 2007), yet only a small number of BRT systems are operational after considerable time and money spent, which means that only a small proportion of the population has benefited from PT improvements (Hitge & Van Dijk, 2012). This indicates a lack of equity in PT reform and points to lower cost alternatives that have the potential to provide quality of service improvements more quickly for more people (Behrens & Salazar Ferro, 2016; Jennings & Behrens, 2017; Schalekamp & Klopp, 2018; Venter, 2016). Likewise, National Treasury recognizes this issue, emphasizing that PT subsidy is expensive and benefits few people (National Treasury, 2019).

Another way to reduce risk to government is to consider relaxing the requirement for universally accessible fleets when spending national Public Transport Network Grant (PTNG) funding. This would allow lower cost vehicles to be purchased where vehicles are a major cost of reform, but more importantly this flexibility would allow PTNG funding to be used for other expenditures around PT reform such as dedicated lanes for existing PT vehicles that would benefit existing PT passengers at relatively low cost. However, because universal accessibility is an important goal for PT systems, the relaxation of this requirement could be done on an interim basis only. Nelson Mandela Bay Municipality allowed MBT owners affected by BRT implementation to keep their vehicles and lease them to the City for operations of feeder routes (Mitchell, 2018). In addition to reducing capital costs for the city, risk to MBT owners was reduced by not asking them to give up operating licenses and vehicles to participate in reform as was the case for MyCiTi and others (Nelson Mandela Bay

Municipality, 2018). This likely reduced resistance from the industry because if the new system failed, they could easily revert back to the status quo. A similar approach of using existing vehicles under a reformed service was used for the TOC pilot where scheduled services and rostered drivers used existing MBT vehicles maintained under individual ownership. Once the pilot proved successful, further changes could be made.

While these interventions have the potential to reduce time and money spent on reforms and the use of pilots like the TOC pilot allow concepts to be tested out at a small scale before larger roll-out, transition support is still needed to move the industry to a new mode of operation. This is evident in the TOC pilot with Assoc B. The association was already undertaking some elements of collective management through ownership of a small depot where vehicles are parked overnight and fuel is dispensed from a commonly-owned pump. Despite this sophistication, a considerable amount of effort was required to facilitate the transition to a scheduled service where drivers were paid salaries based on shifts worked. A consultant was hired to undertake change management, a survey company assessed boarding and alighting to support development of a business model, and a PT scheduling company created the schedule. Vehicles still stopped wherever passengers requested and fares continued to be paid in cash so the transition was not comprehensive and still required this level of effort. Because Assoc B is unique as an association, the apparent success of the TOC pilot does not necessarily prove the concept of this approach, particularly when considering scalability. Support required to transition other associations to a similar structure and service will likely be greater, calling into question how different this approach is from that used in Phase 1. It seems the difference, again in this case only, is that no operating license compensation or vehicle purchases were required.

Perhaps a larger risk involved with any intervention that involves direct incentives to the MBT industry is the sudden increase in cost for government. With MBTs currently providing PT services without direct government expenditure, any move towards incentives adds this cost. While this research has shown that there are much more affordable options for feeder services than the approach used in the past, all but two interventions involve cost to government. The MBT industry has been calling for subsidy for a number of years and government has so far resisted, but this issue may come to a head when the findings of the Competition Commission inquiry into the passenger transport market, per Chapter 4A of the Competition Act (Act 89 of 1998), are released (*Public Passenger Transport Market Inquiry*, n.d.). The Commission may find that subsidy to contracted bus, BRT, and rail services without similar support to MBTs distorts the market. Certainly scholars have suggested that all modes should have equal access to subsidy for a properly competitive environment to exist (Gwilliam & Scurfield, 1996). Though if this does happen, governments should strongly consider using alternative reforms

such as those explored and recommended by this research. Government may also explore a user-side subsidy that includes all modes, as the National Transport Master Plan 2050 indicates. This could lead to quality of service improvements across all modes because passengers will spend their subsidy on the best option available.

In chapter 8 (*Implementation Feasibility*), a tax exemption was discussed as a potential mechanism for increasing acceptability of interventions among drivers. This mechanism did not seem useful related to owners because they were generally willing to pay tax. Care should be taken in imposing tax however. If CFC systems are implemented and cash fares are now visible and therefore taxable, owner earning will decrease to some degree based on individual circumstances. It is possible that owners will then increase fares for passengers to recover that lost income and return their take-home earnings to the original level. This has obvious negative consequences for passengers. In response, government may be tempted to provide subsidy to MBT operators to counteract the fare increase and in doing so have returned the system to the original position but with an added exchange of funding. Hence, to some degree, a tax exemption for owners and drivers can be seen as a backdoor subsidy and may further government's goal of fare affordability while avoiding tax collection costs.

9.3.2 Related to corporatization

Related to the subsidy issue, there may be an interesting dichotomy in perspective associated with the TOC pilot. As discussed in chapter 8 (*Implementation Feasibility*), the TOC pilot was able to provide unsubsidized service if conductors were not paid. The City is likely to consider this a viable reform that can improve service with no ongoing operational cost. However, many owners from these associations made clear that any City monitoring of their vehicles would need to be coupled with some sort of financial support. This suggests a potential tension over the TOC reform approach where government sees it as a subsidy-free solution while operators may expect subsidy, or at least incentives. This mismatch in outlook is likely to cause problems in the future with these associations or with others if the TOC approach is expanded. Expectation management from the outset is key.

The disadvantage of incentives that do not involve contracts with specified levels of service is that quality of service cannot be guaranteed. Whether the increased certainty of improved service quality under a contract is worth the long process of industry transition through compensation, reformulation into companies, and contract negotiation is an important question. Even with contracted service, issues can arise as in Lagos where former paratransit operators were transitioned into BRT operators but eventually replaced by a new operator when quality declined (Alcorn, 2019). Leadership at the time strategically waited until after an election to make the change, removing the possibility of former paratransit operators using the election as a pressure point.

Corporatization does have the advantage of improving working conditions for drivers by shortening working hours and providing salaries. Drivers in Mitchells Plain were heavily in favor of salaried pay and benefits, but acceptability of the Off peak contract intervention was low. A few anecdotes from drivers shed some light on this. An Assoc A driver was concerned that benefits of a contract with the City would go to owners and the association rather than to drivers, and a driver at Assoc B voiced concerns about potential job losses from forming a company. These concerns echo those raised by operators during implementation of Phase 1 of MyCiTi suggesting there is a considerable risk of repeating the past if corporatization is pursued.

Because incorporation of existing MBT operators is a primary way to ensure minimal loss of employment for owners and drivers in the transition to BRT, there is political pressure on negotiations to ensure operators are treated well. This pressure is compounded by the desire to reduce industry resistance and begin operating services without undue delay, resulting in generous contracts that are more costly to government. Provisions for guaranteed minimum kilometers mean operators get paid even during strikes and other disruptions when no services run. The city's shift to a hybrid approach will reduce these risks simply by reducing the instances where newly formed operating companies are negotiating for contracts by leaving MBT operators to continue on more of the network. To some degree initial contracts with former paratransit operators will always be more generous than under a fully competitive tendering environment, so future BRT roll-out will likely face this issue.

Another element costing government is the compensation for withdraw of operating licenses for those owners affected by BRT implementation. Now that compensation has been undertaken in Phase 1, owners elsewhere in Cape Town expect this compensation and have some idea of the value of their license. Unfortunately this cannot be avoided, though it would have been ideal to have used an approach from the start that did not include compensation and therefore did not set this precedent. For other cities in low and middle income countries who have not yet embarked on BRT-related reforms, compensation should be avoided if at all possible. There should also be a clear understanding of the level of effort required to transition operators to formalized and corporatized entities capable of operating contracted services as operators in the MBT industry in Cape Town did not and progress was slow as a result (Schalekamp, 2017a).

9.4 Potential reform approaches

The hybrid approach in Cape Town assumes a continued role for MBTs on feeder routes while BRT is implemented on trunk routes. Because Phase 1 of MyCiTi implementation has highlighted a series of concerns stemming from full replacement of MBTs, this research sought to understand the industry's

perspective on alternative ways to improve services that may prove more feasible. Findings suggest that, as discussed earlier, implementing scheduled and contracted MyCiTi feeder services is not a financially sustainable option. It also appears that the MBT industry finds this solution relatively unacceptable, with five of seven interventions more acceptable to owners and drivers than the Off peak contract intervention that was designed as an equivalent. Therefore, the main recommendation of this research is that the hybrid shift is appropriate; the default assumption of scheduled and contracted feeders in all cases should indeed be reconsidered. From the findings, government should instead assume that no feeders will be scheduled and contracted unless extraordinary circumstances suggest that particular route/service will be profitable or there is a very strong social service argument for a loss-making service. It seems far more prudent to first undertake reforms as recommended by this research, such as Operating deficit payment, to obtain improved quality of service with lower transition costs and risks and only implement contracted service if demand grows enough to cover costs. This will allow limited money for PT to reach more residents and for expenditures to have a much more immediate impact compared to waiting for the next phase of BRT.

Phase 2A of MyCiTi may be planned as a trunk-extension network, where a single vehicle travels across feeder and trunk portions of the route to eliminate transfers for passengers. While this is an improvement and avoids the problems faced in Santiago where the reformed network was overly rigid compared to the previous paratransit offering (Salazar Ferro & Behrens, 2015), all the problems of Phase 1 remain. Compared to the hybrid approach where feeder service is provided by MBTs, having a trunk-extension service forces more operators to be compensated and incorporated than if only trunk services were to be operated as BRT. This maintains the same level of risk, cost, and transition effort as Phase 1 and seems to ignore the hybrid shift.

The TOC pilot, while not an intervention explicitly explored here, appears to be promising as passengers are satisfied with the scheduled services it enabled. However, as discussed in relation to CFC, the change in driver incentives from target to salary plays a big role in this improvement; scheduling services is not the only source of passenger satisfaction with the change. This shift in driver remuneration does not occur with most of the interventions explored: Off peak contract is the only one that would do so. This is a disadvantage. However, there are alternatives to corporatization that can accomplish this critical shift in remuneration such as the approach described for TMCs in Nairobi where drivers are employed by the company and paid a salary plus revenue-based bonus. While a company does exist, owners remain passive investors and operations continue similarly to paratransit with cash fares and without schedules or subsidy. This appears to be a possible stepping stone between MBTs and an operating company and may be useful to encourage in Cape Town if

associations providing feeder services can be transitioned to this structure, with the possibility that associations in a particular area be grouped to form a single company. This consolidation aligns with the city's conceptualization of Regional Taxi Companies (RTCs). However, there is also a possibility that the market will not support such an entity as contracted bus service (GABS) exists. There may not be a large enough niche between MBTs and GABS for a service that operates in some ways like both. In Nairobi, there is no GABS equivalent so offering a service somewhat better than paratransit is a viable option.

While the interventions explored relate specifically to feeder services that link to scheduled services at PTIs, and the purpose of the research is to examine alternatives to the approach used in BRT implementation to date in Cape Town, it is also important to contextualize findings within the broader sphere of paratransit reform in low and middle income countries. Reform can be undertaken alongside and independent of, or prior to, BRT implementation. With the former, this means PT improvements will reach more people sooner; with the latter, there is potential for BRT implementation to be less costly and contentious because institutional and organizational work will have been completed prior to infrastructural changes. Political and institutional issues will be present in any PT reform and implementing a new mode, even under newly formed political structures such as LAMATA or NaMATA, will not avoid them. Therefore, it may be prudent to address these issues first by reorganizing and formalizing paratransit operators to some degree. Later BRT implementation has the potential to be less costly and risky for government because BRT is simply a "tweak" of the existing system rather than a major structural reform. Rather than being the first step in reform, it is merely a physical change to a PT system that has an effective governance framework in place (Díaz & Flores, 2018). This concept is similar to that espoused by Schalekamp, Behrens & Golub (2016) in the stepped, flexible approach to paratransit reform where risk and resistance is reduced when reform is undertaken in a stepwise manner rather than all at once. By undertaking reform this way, passengers receive quality of service improvements and government is able to build capacity over time. And by reorganizing operators, government has built trust and better understands the industry. Hitge & van Dijk (2012) also discuss a piece-wise reform process, suggesting it would allow a "focus on addressing the most pressing issues while capitalising on those components that function well."

One example of this approach is Dakar, where PT reform was completed independent from and prior to BRT implementation and included consolidation similar in some ways to the idea of RTCs in Cape Town. Paratransit operators were reformulated into Economic Interest Groups (EIGs) as a prerequisite for receiving funding for recapitalizing vehicles. A majority of this funding was provided by the World Bank but 25 percent was required to be contributed by the operators; this introduced some delay in

the program but ensured buy-in. World Bank funding was provided as a loan to the EIG with collective responsibility for repaying so any default would be covered by others in the group. All repayments went to a revolving fund that continued to extend the recapitalization money to other operators. Evaluation of the program suggests that improvement could be attributed more to the formalization and fare collection improvements (a paper ticket system was introduced that ensured greater driver/conductor accountability) than from the fleet renewal component (Kumar & Diou, 2010). Only recently has BRT planning begun. This program has key lessons for other cities; formalization was a critical component, yet a corporation was not the required form and not all EIGs participated in recapitalization. Providing financial incentives for participation and maintaining a voluntary approach appears to have worked. No subsidy was required for services, though external money was used for vehicle loans.

Another example of structural reform unrelated to BRT implementation is FUTS from Faisalabad, Pakistan. This reform was discussed in chapter 2 (*Literature Review*). Paratransit operators were allowed to form a society that would coordinate operators and self-regulate, taking the pressure off government to enforce regulations for at least a portion of PT. FUTS employs route inspectors to enforce rules against overloading, poor driving, and use of undesignated stops along the route (Russell & Anjum, 1999). Drivers charge a premium fare that is meant to discourage overloading in vehicles and passengers are willing to pay this premium because trips are more comfortable. The society also restricts entrants to prevent over competition and incentivizes owners for providing service on less profitable routes by lowering the society membership fee (Russell & Anjum, 1999; Sohail et al., 2004). While many characteristics of operations remain like paratransit, there are clear improvements in service from this reorganization which did not require major expenditures for operator compensation or BRT infrastructure.

Also discussed in chapter 2 (*Literature Review*) is the TMC structure from Nairobi. Similar in many ways to FUTS, this unique structure brings benefits to all stakeholders (Plano, Under review). Vehicle owners shift the burden of managing their business to the company, drivers gain a predictable salary and more secure employment, and government finds it easier to work with and gain compliance from the operators via company management. There are passenger service quality improvements stemming from driver salaries, training, and internal company enforcement of behavior on the road, though service remains unscheduled.

Implementing BRT from any of these starting points is relatively straightforward compared to moving from operators loosely affiliated in associations as in Cape Town and many other cities. These structures have records of owners and drivers so identifying those who must be guaranteed no loss of

employment in the transition to BRT is much simpler. Trained personnel are present and have experience in some aspects of collective fleet management, enforcement, and personnel management.

In addition to the earlier shift from full paratransit replacement to a hybrid approach, the City appears to be planning for both BRT and more incremental PT reform simultaneously. The Comprehensive Integrated Transport Plan is being updated and will include support for an incremental approach to PT improvement alongside the corridor approach. It seems the goal is to bring improvements to more people more quickly through smaller scale improvements including security upgrades, stop infrastructure, and dedicated lanes and other priority infrastructure for PT while also continuing to implement BRT in high volume corridors (C. Govender, personal communication, 18 April 2019). It appears that the City's definition of incremental improvements is more expansive than that used by Schalekamp & Behrens (2010), though both use the same principle of smaller-scale interventions to improve existing services irrespective of BRT implementation. This approach is aligned with some recommendations of this research, particularly to spend limited resources more effectively to reach more city residents in a shorter time than BRT has done. However, it remains to be seen whether this important concept can be translated from planning documents to implementation.

9.5 E-hailing and operating licenses

The E-hailing intervention ranked fourth overall, after Operating deficit payment. This intervention is somewhat unique in that it involves a different technology addition than in other interventions and moves somewhat to collective operations through dynamic routing, yet involves no incentives other than the app itself. Fares could be paid either in cash or by bank card and owners were amenable to either because the app records all revenue so there is no risk of drivers underreporting cash fares. These fares could go directly to owners or be passed through drivers, but it seems from owner resistance to drivers being paid directly that it may be more amenable to owners if they are paid first. As was the case with other interventions, owners were resistant to CFC monitoring without some incentive; despite government providing this app for industry use, owners remained resistant to CFC monitoring. One owner noted that such an app would allow them to better compete with MyCiTi services that provide information on arrivals via an app and online. This was an interesting recognition of the changing conditions of the market to which the MBT industry senses they must adapt.

A major disadvantage of this intervention is the reliance on smartphone technology to broker services between passengers and providers. In a lower income area, it is a dubious assumption that a majority of either party have smartphones and can afford the data to use such an app on a regular basis.

During the Smart Matatu program in Nairobi, researchers found that many paratransit owners were not familiar enough with smartphones to use an app designed for the program; this could also be the case in Cape Town among both owners and drivers as well as passengers (Maina, 2017). There are examples of more accessible ways to implement e-hailing services such as Little Cabs in Nairobi though this service is a taxicab equivalent rather than a PT offering (*Little - Ride a Little Better*, n.d.). It is a service backed by Safaricom, the country's largest telecom provider, and uses the company's mobile money service called Mpesa. This is widely used in Kenya and provides an accessible form of payment for passengers who also do not need smartphones for booking because a USSD option is offered. Free Wi-Fi is provided during the ride and the company offers the option to select a female driver at night to make female passengers feel more secure. Rather than using the high income country approach for an e-hailing system, it is worthwhile to look to examples like Little Cabs that are adapted to local contexts.

A major shift required for success of the E-hailing intervention is the change from route-based operating licenses to area-based. Under the current regime, each vehicle is limited to specific street segments based on turn-by-turn descriptions listed in the operating license, but e-hailing MBTs would be dynamically routed based on passenger boarding and alighting requests and would need to be authorized to operate on any part of the road network within a specified feeder area. To do this, licenses would need to ring-fence a feeder area and impose penalties not for being off-route but instead for being out-of-area. The OLAS discussed in *9.2 Implications for incentivized interventions* is intended to streamline enforcement and provide SMS and email warnings to owners when their vehicles are off-route. This could easily be adjusted for an area-based license.

A shift to area-based licensing has been suggested by others (Du Preez, 2018) as a way to increase oversight; interestingly, owners at Assoc B assumed that this shift would come with stricter oversight yet 82 percent still supported this change. Drivers were asked if they could make more money in other areas of Mitchells Plain and 67 percent responded yes; drivers could also indicate where via open response and 37 percent of responses (not individuals, as each could provide more than one response) stated line-haul routes rather than feeder routes. This persistent assumption that line-haul routes are more profitable than feeder routes despite research to the contrary (Del Mistro & Behrens, 2015) highlights an interesting implementation challenge, but also an opportunity to right-size fleets and coordinate service in a way that makes operations more efficient as was done in the TOC pilot. The current challenges around rail decline in service quality make line-haul routes more attractive for the steady demand which highlights the complicated nature of PT reform efforts.

Some may see a shift to area-based licensing as a return to a previous regulatory regime that was untenable; as discussed in chapter 2 (*Literature Review*), the White Paper on National Transport Policy of 1996 recommended a route-based licensing structure that was intended to provide clearly defined and separate operating areas for MBTs to address violent conflicts between operators. At the time, radial licenses allowed operation in broad areas of the city with large overlap so on the road competition was intense. Certainly returning to this environment would be problematic and the area-based licenses proposed here would be for much smaller and better-defined areas, with specific boundaries. Some issues of the past arose not from the form of operating license but from the willingness of government to issue permits with little restriction during an era of deregulation (Woolf & Joubert, 2013) which should be avoided. There might be benefits to providing small areas of overlap on the edges of these defined areas so that passengers are able to transfer between feeder zone areas directly rather than traveling through a single common PTI. In Santiago, this overlap was 800 meters (Salazar Ferro & Behrens, 2013).

Separate from the shift to area licensing is a discussion of the incentives under the current licensing regime to keep an overly large supply of vehicles operating. Rules state that any vehicle with a valid operating license not found to be operating when the City conducts 180-day surveys can be eligible for cancellation as it is assumed that this is excess capacity and no longer needed. However, with the advent of compensation packages associated with BRT implementation, operating licenses have considerable value. Owners now have an incentive to continue operating even if faced with considerable over competition on the road because of the potential for compensation when MyCiTi is rolled out in their area. In the intervening years, this can cause issues of aggressive driving and congestion if too many vehicles are competing for too few passengers. However, to be clear, MBTs are not the cause of congestion in Cape Town and are inherently more efficient than private vehicles even when only partially full.

9.6 Context and engagement

An important finding of this research is a confirmation that, within the MBT industry, micro-context matters. Despite Assoc A and Assoc B operating similar services from the same PTI within similar neighborhoods, there are differences in leadership, outlook, and perspectives on the interventions. For example, Assoc A strongly emphasized the need for improved security from the presence of a SAPS officer at the rank while at Assoc B this was a lesser concern. Assoc B has collectivized fueling and overnight vehicle parking and engages in some monitoring of driver trips, while Assoc A has coordinated a system for providing unviable early trips. These differences are particularly clear when looking at the additional associations in Wynberg and Retreat. The respondent from Assoc D is an

owner-driver who also has additional vehicles rented to drivers, though on a unique arrangement around maintenance responsibility. The Assoc E respondent rents his license from the true holder, setting up a relationship somewhat similar to that between an owner and a driver. These differences exist despite the fact that all operate similar feeder routes from major PTIs.

Despite these differences, there are some similarities even with associations in Wynberg and Retreat. The respondent from Assoc E espoused a similar customer service orientation as many owners and drivers in Assoc A, indicating he will take passengers home in the evening from the PTI because he lives in the same neighborhood. He also stated his dislike of drivers who overload passengers. Respondents from three associations (Assoc A, Assoc C, and Assoc E) were in favor of shareholding within a corporatized association because it would mean less work for them. This is also similar to perspectives shared by interviewees in Nairobi who suggested TMCs provide owners a steady income for less work compared to managing the paratransit business independently.

Another interesting finding is that power dynamics appeared to play only a minor role in decision-making at Assoc A and Assoc B. Data collection with owners from the focus groups first captured individual perspectives, followed by the group; it was theorized that strong personalities could override those of other opinions and produce a group response that did not align with the aggregated individual responses. This did not happen, however. Power dynamics may play a stronger role in other associations.

Together these findings emphasize the importance of engaging with the MBT industry from the early stages of reform planning. The Nelson Mandela Bay Municipality created an Industry Consultative Committee to engage with the industry in planning, which has the potential to streamline reforms when issues and resistance can be identified and addressed early on (Mitchell, 2018). Often resistance may be pre-empted because of good faith engagement and open sharing of information on the part of government.

9.7 Summary

After service quality issues between scheduled and unscheduled PT services at the Mitchells Plain PTI had been identified, this research considered what interventions would address these issues of mismatched service spans and long off peak headways and engaged with MBT drivers and owners to determine which would be most feasible to implement. Driver perspectives on these interventions were presented in chapter 6 (*Drivers*) and the owner perspective in chapter 7 (*Owners*). Additional information such as cost of interventions to government, an important concern considering the high

except for exceptional situations. For any reforms to be successful, government must meaningfully engage with the industry and consider the micro-context particular to that association.

The next chapter reviews this work and provides an overall conclusion.

10 Conclusion

The purpose of this research was to explore the feasibility of interventions to extend MBT service and maintain short headways to improve passenger quality of service. These goals arise from the fact that scheduled and unscheduled services coexist in the PT network in Cape Town and in many places, though in particular at the Mitchells Plain PTI, service spans do not match and MBT off peak headways can be long. To ensure passengers can use services that are physically integrated, these two service quality issues must be addressed. However, the MBT industry operates profitably and the City has no control over headways or service span as would be the case with contracted service. Therefore, it becomes necessary to understand what interventions may be successful in addressing mismatched service spans and long off peak headways. A key component of this success hinges on MBT operator acceptance of interventions because of resistance to past reforms around implementing MyCiTi BRT services. This resistance has led to a lengthy and expensive transition process, including operating license compensation, capacity building, and generous negotiated contracts. And new scheduled MyCiTi services have proven more expensive to operate than intended, adding considerably to the subsidy burden of government.

In light of the difficult transition and ongoing operational costs, the City has reevaluated the approach to reform; future reform will employ the hybrid model where MBT operators provide feeder services while scheduled services provide trunk service. This means that scheduled and unscheduled modes will continue to coexist in the PT network and the harmonization of these services is a key passenger service quality issue. Mitchells Plain is essentially a naturally occurring example of this future hybrid network. Past research indicates issues around mismatched service spans and headways while this research explores interventions to address these issues by working directly with MBT owners and drivers to understand their willingness to implement them. By knowing this in advance, resistance and therefore time and cost to the City for reforms will be reduced and passengers will receive the benefits of PT reforms more quickly. By understanding the cost of alternatives to formalized and scheduled feeders, government can make informed decisions about how to implement the envisioned hybrid network. This research seeks to provide such information.

More specifically, the following research questions have been answered:

- What issues arise when scheduled and unscheduled PT modes meet at a transfer point?
- What interventions, as alternatives to comprehensive BRT implementation and paratransit assimilation, might address these issues?

- What interventions to increase service span and/or decrease headways of MBT feeder services in off peak periods are acceptable to drivers?
- What interventions to increase service span and/or decrease headways of MBT feeder services in off peak periods are acceptable to owners?
- What will the interventions cost the public authority to sustain?
- What interventions to increase service span and/or decrease headways of MBT feeder services in off peak periods are most feasible to implement?
- What implications do intervention feasibility have for policy and regulation?

Before summarizing the answers to these questions, the mixed methods described in chapter 4 (*Method*) are briefly reviewed. The most important first step of this research was building trust and personal relationships first with leadership of the associations then with the other owners and drivers. Both owners and drivers and others at ranks, like rank marshals, are more willing to share information once you have an established relationship. Over time and many visits to the rank, information was more openly shared with me. These were unstructured discussions that sought to understand the passenger demand and travel patterns, history of the association and area, and current operating challenges. This process also confirmed the lack of service complementarity between scheduled and unscheduled PT and provided a foundation for designing interventions to address them.

Intervention design started with a review of the literature for examples and precedents where efforts were made to integrate paratransit and scheduled PT at transfer points. This literature is limited because many reforms go undocumented and much of PT reform focuses on comprehensive BRT implementation rather than alternative paratransit reform approaches. Consultation with experts was invaluable for design and refinement of the interventions based on literature precedents. Academics, practitioners, and government officials knowledgeable in the MBT space provided feedback and interventions were amended accordingly. The final set of interventions number seven in total. They vary in approach and impact; some address only the service span mismatch by encouraging drivers to provide additional trips past 7 pm, while others do this and also attempt to maintain short headways to reduce wait time for passengers. Details on intervention design and the interventions themselves can be found in chapter 5 (*Interventions*).

Because interventions were intended to affect operational characteristics of the service and drivers are the primary operational decision-makers, drivers were engaged first through a SC survey described in chapter 6 (*Drivers*). This method is typically used for determining passenger demand for various modes, but in this case was used to gauge driver willingness to provide service under varying conditions. A key output of this survey was acceptability of each intervention from the driver

benefit, and more quickly, than if MyCiTi implementation continues as in Phase 1. Phase 2A is not expected to be fully operational until 2027 with interim service in 2021; all phases are perhaps optimistically estimated to be complete in 20 years. For those who benefit only in the final phase of implementation, this is a long time to wait. Interventions that require lower transition and operational costs mean more improvements can be made more quickly, shortening this time considerably.

This research supports the city's shift to hybridity when planning for PT improvements; by allowing feeders to be improved in alternative ways, benefit accrue to all stakeholders as discussed above. If the City considers the industry perspective as this research does, MBT owners and drivers are more likely to be satisfied and amenable to reforms. However, plans and intentions must translate to implementation and City officials must avoid falling back into the comfort of engineering and optimization to the detriment of meaningful engagement. Scholars have suggested government in Solo, Indonesia recognize the "entrepreneurial propensity" of paratransit operators rather than force formalization; this mantra should be considered in Cape Town as well (Song, 2016). In addition to addressing the key challenges faced in Phase 1, use of alternative interventions allows City officials to build trust with the MBT industry stakeholders over time.

Learning from other South African cities should be a primary goal for practitioners in South Africa. This may seem an obvious statement, but many of the lessons around BRT were learned from South American cities that in many cases have different characteristics (Scorcia & Munoz-Raskin, 2019). This played a role in the overly optimistic expectations of BRT within the South African context. Therefore it is key to take lessons only from comparable locations, or carefully consider how different contexts may impact lessons. The Nelson Mandela Bay Municipality faced a similar challenge as Assoc B did around unions; Assoc B had previously and independently tried to collectivize fleet management, paying drivers daily wages over the course of almost two years. However, agreement could not be reached between owners and drivers on a fair wage and drivers involved a union, which then scared owners into returning to the status quo (Schalekamp & Klopp, 2018). In Nelson Mandela Bay, negotiated rates for drivers did not align with SARPBAC rates and precipitated issues with unions (Mitchell, 2018). If City officials had been regularly sharing lessons, this issue could have been avoided.

Despite the caution about learning from locations within different contexts, cities both within and without South Africa must heed the findings of this research and consider alternatives to full replacement of paratransit operators. Many African cities, such as Lagos, are still planning for this: "Ultimately, LAMATA envisions that modern, formal buses operated by professionally-trained staff on fixed routes with regular schedules will entirely replace the current informal network of tens of

thousands of danfos in Lagos" (Alcorn, 2019). Lagos may be successful in this endeavor, but it seems unlikely and City officials should attempt a course correction sooner rather than later.

Therefore, the contribution of this research is threefold. Firstly, the original use of a SC survey to determine the willingness to provide a PT service, particularly with paratransit drivers, appears not to have been done before. This is a contribution to method, and details around survey design and administration, lessons learned, and drawbacks to this approach are discussed in chapter 6 (*Drivers*). More generally, this study contributes to the scholarly literature on paratransit reform, a field in which limited academic work has been completed. Secondly, this research contributes useful policy direction to City officials. City policy indicates a shift to hybridity, but little detail exists around how to implement a hybrid network in partnership with the MBT industry. This study explored implementation options and gives some direction to City officials. It also engaged the MBT industry holistically, seeking to understand both owner and driver perspectives—critical to the success of any reform—on reforms outside of a City-led engagement process with a pre-determined outcome. By considering a wider scope of reforms (not just corporatization and formalization associated with BRT), it highlights potential avenues for government to reduce costs and transition difficulty to bring PT reforms to more city residents more quickly. And lastly, while this study is not intended to be generalizable to other cities in South Africa or other low and middle income countries, it does contribute to the wider theoretical debate around PT reform in such places. Indeed, findings indicate that context is important; associations at the same PTI in a single city vary in organization, sophistication, and perspectives on reforms. However, the MBT industry exists in other cities in South Africa and other low and middle income countries have similar paratransit services. Many are considering PT reforms and many of these reforms are centered around BRT. This research suggests that, because alternatives appear to be feasible in Cape Town, cities should evaluate a wider range of reform options rather than dismissing the existing paratransit system.

While this research presents a holistic perspective of the MBT industry in the sense that both main stakeholders, drivers and owners, are considered, it does not claim to be representative of the MBT industry in Cape Town as a whole. This would be almost impossible to do short of a census of all individuals within all associations. As discussed above, the micro-context for Assoc A and Assoc B impacted responses despite these associations operating similar feeder routes from the same PTI. This further supports the need for City officials to engage early and often and with each association they are interested in working with. The associations in Mitchells Plain are also unlikely to be representative because of past involvement in capacity-building workshops and the TOC pilot and the collective management activities undertaken independently by Assoc B and to a lesser degree Assoc

A; perspectives from other owners and drivers in other associations may differ without this external influence.

Future research could expand the mixed methods approach used here to other associations in Cape Town to consider the question of representativeness. Extending this research to pilots and trials is a critical next step; important details around logistics of implementation remain to be worked out and small-scale implementation can consider these. However, this may be more appropriately undertaken by practitioners rather than researchers. CFC seems to be a barrier in all attempted reforms so this area requires particular attention. While fully cashless systems hold promise, fees and the need for additional technology appear to hinder successful implementation; creative thinking must be applied to consider how to address these issues using paper-based or other systems as an interim step. Likewise, development of effective monitoring and administrative systems within city governments will enable interventions to succeed, though this may also be a topic most appropriately considered from the government side.

Irrespective of topic, there is a critical need for "genuinely co-produced research" that helps practitioners to address PT service quality issues as effectively and efficiently as possible. The quality of life and economic well-being of residents depend on it and improvements that are costly and difficult to implement hinder government's pursuit of these goals. By engaging with the MBT industry, this research has attempted to co-produce knowledge that will provide insight to City officials as they consider mechanisms to ensure success of the hybrid network in Cape Town.

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Discussion guide

Questions (90 min)

1. What is the normal fare charged? (5 min)
    a. Time of day
    b. Pay more

2. When do you start and finish service? (10 min)
    a. # of trips/day or hour
    b. Who decides

3. *note these to return to later*) (15 min)
    a. Dominant one

4. What are the security issues you face? (20 min)
    a. Most critical
    b. Desired situation

5. Would cashless fare collection help improve security? (20 min)
    a. Their understanding
    b. Like/dislike
    c. Driver v. owner
    d. Integrated (trust)
    e. Paying for fuel
    f. Driver on salary

6. How many passengers are needed to provide service? (10 min)
    a. Per hour
    b. Per trip
    c. How measure

7. How does the early morning incentive scheme work? (10 min)
    a. # of passengers to break even
    b. Not evening

8. When night service was offered before, how many passengers rode? (5 min)
    a. Same if now
    b. Pay more

9. Discuss any other reasons mentioned earlier for not providing service. (10 min)

10. (*if time*) In your opinion, what does good taxi service look like?

Conclusion (5 min)

Anything else you want to tell us? Anything we missed?
Thank you learned from you

Questionnaire please fill it out

C: Driver SC survey data collection

Ethics approval

Application for Approval of Ethics in Research (EiR) Projects
Faculty of Engineering and the Built Environment, University of Cape Town

APPLICATION FORM

Please Note:
Any person planning to undertake research in the Faculty of Engineering and the Built Environment (EBE) at the University of Cape Town is required to complete this form **before** collecting or analysing data.The objective of submitting this application *prior* to embarking on research is to ensure that the highest ethical standards in research, conducted under the auspices of the EBE Faculty, are met. Please ensure that you have read, and understood the **EBE Ethics in Research Handbook**(available from the UCT EBE, Research Ethics website) prior to completing this application form: http://www.ebe.uct.ac.za/usr/ebe/research/ethics.pdf

APPLICANT'S DETAILS		
Name of principal researcher, student or external applicant		Christopher Plano
Department		Civil Engineering
Preferred email address of applicant:		Plnchr004@myuct.ac.za
If a Student	Your Degree: e.g., MSc, PhD, etc.,	MPhil, Transport Studies
	Name of Supervisor (if supervised):	Roger Behrens, Mark Zuidgeest
If this is a researchcontract, indicate the source of funding/sponsorship		Click here to enter text.
Project Title		Integrating Unscheduled and Scheduled Public Transport Services at Mitchells Plain PTI

I hereby undertake to carry out my research in such a way that:

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University;
- the stated objective will be achieved, and the findings will have a high degree of validity;
- limitations and alternative interpretations will be considered;
- the findings could be subject to peer review and publicly available; and
- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism.

SIGNED BY	Full name	Signature	Date
Principal Researcher/ Student/External applicant	Christopher Plano	signature Removed	**10 Aug 2017**

APPLICATION APPROVED BY	Full name	Signature	Date
Supervisor (where applicable)	Roger Behrens	Signature Removed	**14 Aug 2017**
HOD (or delegated nominee) Final authority for all applicants who have answered NO to all questions in Section1; and for all Undergraduateresearch (Including Honours).	Click here to enter text.		Click here to enter a date.
Chair : Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the above questions.	G. Sithde Click here to enter text.	Signature Removed	31/08/2017 Click here to enter a date.

Page 1 of 1

Introductory letter to participants

Faculty of Engineering & the Built Environment

Chris Plano – Candidate, MPhil in Transport Studies

5th level, New Engineering Building
Madiba Circle, Upper Campus,
University of Cape Town, Rondebosch
[redacted]
Internet: www.uct.ac.za

Dear sir/ma'am,

Thank you for participating in this survey. This letter gives you information about the the research you are participating in.

The research is part of Chris Plano's degree work at the University of Cape Town. I am studying for a master's degree in Transport Studies. I am not working with the City of Cape Town or MyCiTi in any way. The research aims to better understand how the minibus-taxi business relates to other transport.

Your responses to the survey are confidential – your name will not be recorded. Results from the study will be published in academic documents, but never reported by individual. No negative consequences will result from your participation in the research, and we are not providing any incentives.

Thank you again for participating in my research. If you have any questions, please contact me or my supervisor.

Best,
Chris Plano

[redacted]

Supervisor: Roger Behrens
[redacted]

Sample of SC survey questionnaire

Example
No braai spots
30 min drive (one way)
R 50 to enter the park

_____

Would you travel to the park?

☐Definitely Yes
☐Probably Yes
☐Unsure
☐Probably No
☐Definitely No

1
Cashless fares (no cash in van)
Vans leave every 20 min (even if not full)
You make R 40 profit (all costs covered)
Armed SAPS at rank

_____

Would you drive your van from 7 pm to 10 pm?

☐Definitely Yes
☐Probably Yes
☐Unsure
☐Probably No
☐Definitely No

2
Cashless fares (no cash in van)
Vans leave when full
You make R 50 profit (all costs covered)
Security guards at rank

_____

Would you drive your van from 7 pm to 10 pm?

☐Definitely Yes
☐Probably Yes
☐Unsure
☐Probably No
☐Definitely No

3
Cashless fares (no cash in van)
Vans leave when full
You make R 60 profit (all costs covered)
Armed SAPS at rank

_____

Would you drive your van from 7 pm to 10 pm?

☐Definitely Yes
☐Probably Yes
☐Unsure
☐Probably No
☐Definitely No

4
Cash fares
Vans leave when full
You make R 30 profit (all costs covered)
Armed SAPS at rank

_____

Would you drive your van from 7 pm to 10 pm?

☐Definitely Yes
☐Probably Yes
☐Unsure
☐Probably No
☐Definitely No

D: Owner focus group data collection

Ethics approval

Application for Approval of Ethics in Research (EiR) Projects
Faculty of Engineering and the Built Environment, University of Cape Town

APPLICATION FORM

Please Note:
Any person planning to undertake research in the Faculty of Engineering and the Built Environment (EBE) at the University of Cape Town is required to complete this form **before** collecting or analysing data. The objective of submitting this application *prior* to embarking on research is to ensure that the highest ethical standards in research, conducted under the auspices of the EBE Faculty, are met. Please ensure that you have read, and understood the **EBE Ethics in Research Handbook** (available from the UCT EBE, Research Ethics website) prior to completing this application form: http://www.ebe.uct.ac.za/usr/ebe/research/ethics.pdf

APPLICANT'S DETAILS		
Name of principal researcher, student or external applicant		Christopher Plano
Department		Civil Engineering
Preferred email address of applicant:		Plnchr004@myuct.ac.za
If a Student	Your Degree: e.g., MSc, PhD, etc.,	PhD, Transport Studies
	Name of Supervisor (if supervised):	Roger Behrens
If this is a researchcontract, indicate the source of funding/sponsorship		Click here to enter text.
Project Title		Integrating Unscheduled and Scheduled Public Transport Services at Mitchells Plain PTI

I hereby undertake to carry out my research in such a way that:

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University;
- the stated objective will be achieved, and the findings will have a high degree of validity;
- limitations and alternative interpretations will be considered;
- the findings could be subject to peer review and publicly available; and
- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism.

SIGNED BY	Full name	Signature	Date
Principal Researcher/ Student/External applicant	Christopher Plano	signature Removed	**17 Jul 2018**

APPLICATION APPROVED BY	Full name	Signature	Date
Supervisor (where applicable)	Roger Behrens	Signature Removed	**18 Jul 2018**
HOD (or delegated nominee) Final authority for all applicants who have answered NO to all questions in Section1; and for all Undergraduateresearch (Including Honours).	Click here to enter text.		Click here to enter a date.
Chair : Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the above questions.	ADENIYI Click here to enter text. ISAFIADE	Signature Removed	2 AUG Click here to enter a date. 2018

P.P

Page **1** of **1**

Introductory letter to participants

Faculty of Engineering & the Built Environment

Chris Plano – Candidate, DPhil in Transport Studies

5th level, New Engineering Building
Madiba Circle, Upper Campus,
University of Cape Town, Rondebosch
[redacted]
Internet: www.uct.ac.za

Dear sir/ma'am,

Thank you for participating in this group discussion. This letter gives you information about the research you are participating in.

The research is part of Chris Plano's degree work at the University of Cape Town. I am studying for a PhD in Transport Studies. The research aims to better understand your feelings about potential changes to how the minibus-taxi business operates.

A few important things:

- Participation is voluntary and you can leave at any time.
- A note-taker will record discussion, but your name will not be recorded. However, others in the group will know what you say.
- The discussion will be less than 2.5 hours

Results from the study will be published in academic documents, but your individual identify will never be revealed. No negative consequences will result from your participation in the research, and we are not providing any incentives.

Thank you again for participating in my research. If you have any questions, please contact me or my supervisor.

Best,
Chris Plano

[redacted]

Supervisor: Roger Behrens
[redacted]

Discussion guide

Topic	Details	Time
Intro/consent	▪ PhD research ▪ Taxi owner opinions on changes ▪ Introductory Letter ▪ Consent and questions	10 :10
Overview	▪ Want extended taxi service to match (7-10 pm) ▪ 7 ways to do it/each one requires things to work ▪ Process for focus group	10 :20

1. Rank security	Explanation	▪ SAPS officer at the rank	15
	Indicators	▪ Extra income	:35
2. Transfer bonus	Explanation	▪ Driver paid per pax – must transfer ▪ Need to track pax for pay, so no cash fares	30
	Indicators	▪ CFC ▪ Tracker ▪ Tax ▪ Extra income ▪ Paid directly	1:05
3. Headway bonus	Explanation	▪ < 30 min departure = bonus regardless of pax ▪ Short wait for pax	15
	Indicators	▪ Tracker ▪ Extra income ▪ Paid directly	1:20
4. Operating deficit payment	Explanation	▪ Costs paid/small profit each trip ▪ Even if few pax, still make something	20
	Indicators	▪ CFC ▪ Tracker ▪ Tax ▪ Extra income ▪ Paid directly	1:40
5. E-hailing	Explanation	▪ City provides app for requesting, tracking, payment? ▪ Could reduce wasted km ▪ Likely use this all day	20
	Indicators	▪ CFC ▪ Tracker ▪ Tax ▪ Pax tracking ▪ Route ▪ Paid directly	2:00
6. Off-peak contract	Explanation	▪ Rules for hours, departures, driver wage ▪ Company owns vehicles ▪ City pays per km	20
	Indicators	▪ CFC ▪ Tracker ▪ Tax ▪ Company ▪ Fewer vans ▪ Control ▪ Pay trust	2:20
7. Higher fare	Explanation	▪ Higher fare	15
	Indicators	▪ Extra income ▪ Higher fare	2:35

E: Chi-square results

Table 56. Results of statistical tests from section 7.2.1 Respondent characteristics *to determine if respondent characteristics impact intervention acceptability. Green indicates significance at 0.05 level. Two-sided p-value shown for N-1 Chi square test. No test conducted for Sole income, Rank security, or Off peak contract because all responses yes.*

		Rank security	Transfer bonus	Headway bonus	Op. deficit payment	E-hailing	Off peak contract	Higher evening fare
Vehicle count	N-1 Chi square	no test	0.714	0.007	0.065	0.714	no test	0.333
	p-value	no test	0.398	0.932	0.799	0.398	no test	0.564
	Cramer's V	no test	0.218	0.023	0.068	0.218	no test	0.149
	p-value	no test	0.383	0.930	0.792	0.383	no test	0.551
Sole income	N-1 Chi square	no test	no test	no test	no test	no test	no test	no test
	p-value	no test	no test	no test	no test	no test	no test	no test
	Cramer's V	no test	no test	no test	no test	no test	no test	no test
	p-value	no test	no test	no test	no test	no test	no test	no test
Executive member	N-1 Chi square	no test	1.667	0.960	0.173	0.034	no test	2.683
	p-value	no test	0.197	0.327	0.678	0.854	no test	0.101
	Cramer's V	no test	0.333	0.262	0.111	0.048	no test	0.423
	p-value	no test	0.182	0.310	0.667	0.849	no test	0.091
Years in industry	N-1 Chi square	no test	0.000	5.818	1.500	2.143	no test	4.000
	p-value	no test	1.000	0.016	0.221	0.143	no test	0.046
	Cramer's V	no test	0.000	0.645	0.327	0.378	no test	0.516
	p-value	no test	1.000	0.013	0.205	0.131	no test	0.039
Gender	N-1 Chi square	no test	0.143	0.364	0.667	7.000	no test	0.600
	p-value	no test	0.705	0.546	0.414	0.008	no test	0.439
	Cramer's V	no test	0.098	0.161	0.218	0.683	no test	0.200
	p-value	no test	0.696	0.533	0.398	0.006	no test	0.424
Age	N-1 Chi square	no test	0.034	0.212	0.173	1.667	no test	0.143
	p-value	no test	0.854	0.645	0.678	0.197	no test	0.705
	Cramer's V	no test	0.048	0.123	0.111	0.333	no test	0.098
	p-value	no test	0.849	0.634	0.667	0.182	no test	0.696
Household size	N-1 Chi square	no test	0.495	1.273	0.065	0.495	no test	0.026
	p-value	no test	0.482	0.259	0.799	0.482	no test	0.873
	Cramer's V	no test	0.182	0.302	0.068	0.182	no test	0.041
	p-value	no test	0.468	0.243	0.792	0.468	no test	0.869