PARATRANSIT AND FORMAL PUBLIC TRANSPORT OPERATIONAL COMPLEMENTARITY: IMPERATIVES, ALTERNATIVES AND DILEMMAS

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ABSTRACT

Most urban public transport systems in the Global South undoubtedly require urgent change. The common approaches to such transformation include the introduction of catalytic and, more often than not, infrastructure-heavy projects that seek the modernisation of the system and the substitution, gradual or rapid, of traditional private public system operators. Often mistakenly referred to as 'informal' services, these private 'paratransit' operators display characteristics that can be utilised to build a sustainable public transport system: a 'hybrid' system combining 'paratransit' and 'planned' services. Ignoring their continued presence may jeopardise the transformation itself.

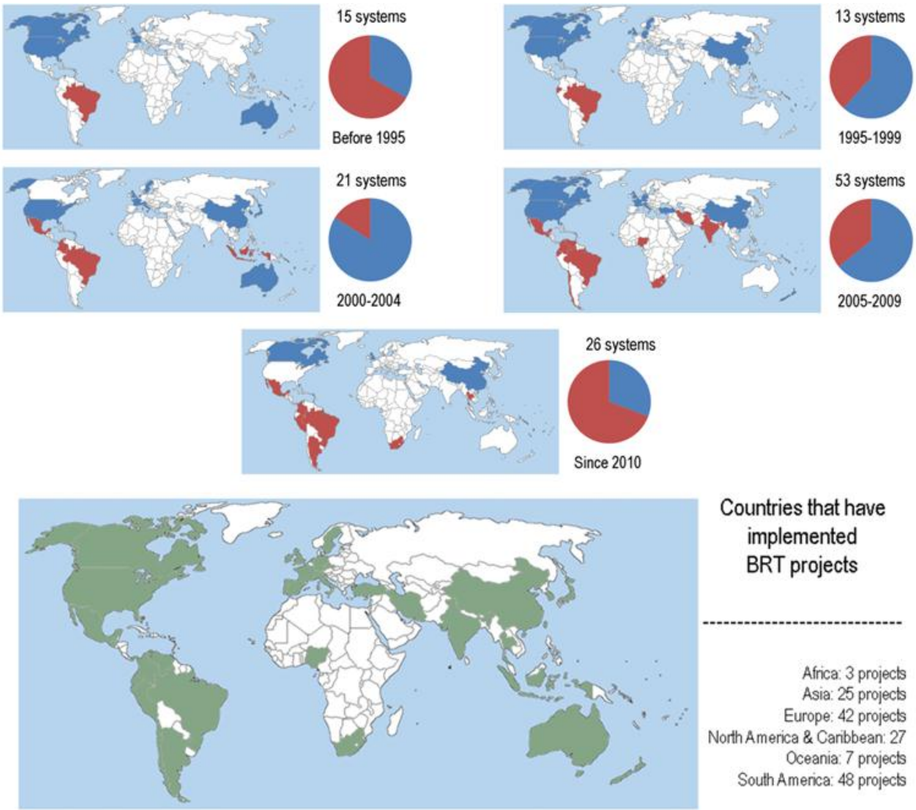
In order to analyse the role of 'paratransit' services during transformational processes in cities of the Global South, a categorisation of 'hybrid' systems is introduced. Three main types of systems are defined: (1) systems with least recognition of 'paratransit' services; (2) systems with greatest recognition of 'paratransit' services; and (3) systems with a late but significant recognition of 'paratransit' services. The presented analysis focuses on the third type of system, where novel schemes to introduce 'paratransit' services as a further component of an integrated system are explored.

Encouraged by recent tentative shifts in South African public transport policy discourse, an analysis of the possibilities for inclusion of 'paratransit' services in a 'hybrid' feeder-trunk-distributor system is conducted. Under this scheme, trunk services are provided by the 'planned' network, while 'paratransit' operators are responsible for feeder services. Using a context-conscious case study research method, the prospects of achieving complementarity between 'paratransit' and 'planned' services are explored and presented. It is argued that the benefits of either paratransit or formal public transport operations are eroded when seeking complementarity between these modes in a 'hybrid' feeder-trunk-distributor arrangement: either the formal trunk public transport operations are rendered less efficient or the paratransit services are rendered less demand-responsive and flexible.

Keywords: Public transport, operational complementarity, feeder-trunk-distributor, trunk-and-feeder, BRT

INTRODUCTION

In cities of the Global South, many current public transport restructuring processes rely on the introduction of new 'formal' and officially sanctioned modes. Such modes often take the form of bus rapid transit (BRT) (Figure 1 shows the extent of implementation of these systems in the world). In most of these cities, BRT proposals are expected to be catalysts in the overhaul of existing transport systems (Gauthier and Weinstock, 2010; Pardo, 2009). As a result of these processes, operational relationships between incumbent private and, sometimes, illegal operators and their formal counterparts are fundamentally altered.

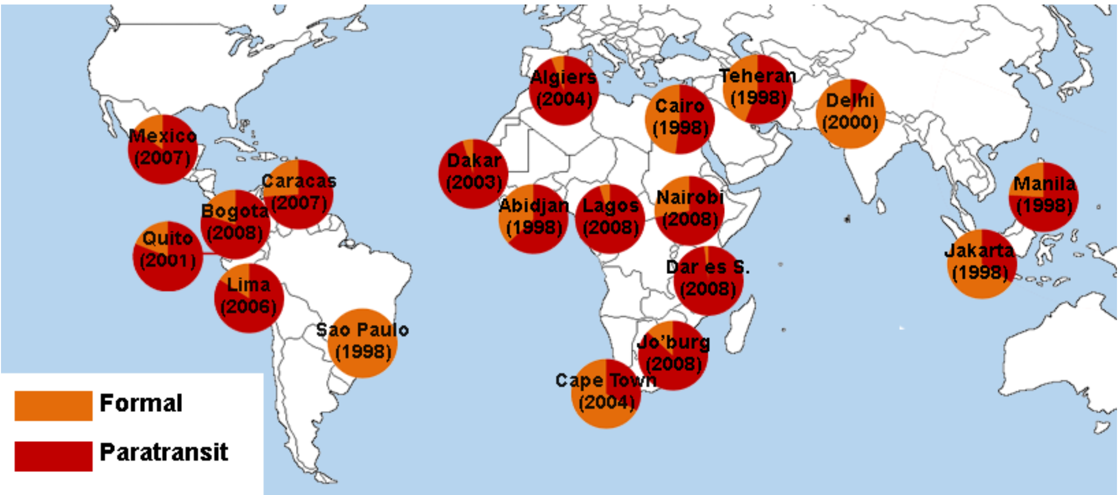


Source: Authors using brtdata.org, accessed September 2012.

Figure 1: BRT systems (or similar) implementation in the world

Frequently, the envisioned role of incumbent paratransit operators in the new system is marginal: gradual or rapid substitution is envisaged. Traditional paratransit services are expected to fade away once the new 'formal' and 'modern' system is implemented. Only a few cities have recognised a role for incumbent operators. When recognised, incumbent operators are expected to change business practices in a quest for modernisation and increased efficiency of the public transport system. Irrespective of whether a gradual or rapid paratransit substitution strategy is pursued, the difficulty of implementing comprehensive change in cities of the Global South is likely to dictate that newly implemented modes will coexist, if not indefinitely then at least for a significant period of time, with the modes they were meant to replace (Salazar Ferro *et al.*, 2012a). This creates a public transport system in which the relationships between the new and the existing systems are ambiguous. In other words, the result is a system in which the role of paratransit is unclear.

Without doubt, in the Global South, the paratransit sector has organisational[1] and operational[2] problems that hinder their inclusion in new public transport systems as service providers. Yet, at the same time, these same paratransit services are widely acknowledged to be flexible and demand responsive (Avellaneda García, 2007). Evidence suggests that, in most cities of the Global South, even with their deficiencies, paratransit services have become the dominant public transport mode (Figure 2 shows selected examples of modal share between planned and paratransit services). They provide the only means of accessing the city for many low-income inhabitants (Lomme, 2008; Avellaneda García, 2007).



Note: The distributions presented in the image are indicative of the importance of paratransit in the world. The modal share of paratransit will depend on the definition of paratransit any one author is using.

Source: Authors using Avellaneda García, 2007, Demoraes, 2006; Flores and Zegras, 2012; Godard, 2008, Grey, 2006; Lizarraga, 2012; UATP and UITP, 2010

Figure 2: Planned and paratransit modal share of rail and bus services in selected cities of the Global South

Where public transport restructuring programmes have been undertaken, relationships between paratransit and newly implemented BRT systems have been altered and remain relatively unstable. Each system has different business structures, imperatives and operational rationales that obstruct attempts at integration. Yet, it has been argued that integration between paratransit and formal services, through the inclusion of paratransit operations in transformational processes, can produce more sustainable public transport systems (Salazar Ferro *et al.*, 2012a).

1 Organisational problems include fragmented ownership and the appearance of illegal service providers (Cervero and Golub, 2007; Montezuma, 1996).

2 Operational problems include route duplication, gradually smaller vehicle sizes and, most importantly, dangerous competition in the market (*i.e.* penny wars).

This study explores the complexities of this relationship by analysing selected cases of formal-paratransit operational complementarity[3] options. In section 1, the definition and selected types of hybrid transport systems are introduced. The next section focuses on presenting different alternatives for operational complementarity between formal and paratransit services. Section 3 then presents an analysis of one of those alternatives: the feeder-trunk-distributor model. Two different approaches to complementarity are then defined: route-based and area-based arrangements. Sections 4 and 5 analyse selected cases of route-based and area-based arrangements respectively. The next section draws lessons for another city in the midst of a transformational process: Cape Town (South Africa). The conclusions of the study are discussed in the last section.

1. HYBRID PUBLIC TRANSPORT SYSTEMS

Even if not planned by authorities, most cities in the Global South depend on a hybrid urban public transport system composed of paratransit[4] and formal[5] operations. The combination of paratransit and formal services is the main feature of hybrid systems (Salazar Ferro *et al.*, 2012a). More often than not, integration and, more importantly for this study, operational complementarity are missing between formal and paratransit services (Salazar Ferro *et al.*, 2012b). In terms of network location in the city, formal services usually occupy the higher demand corridors and paratransit operations are left with, or displaced to, secondary transport corridors (Figueroa, 2005).Their business and operational logics haven proven to be difficult to combine.

Recently, many cities in the Global South have started or planned public transport projects meant to restructure the existing system (hybrid or fully paratransit). With BRT initiatives being the more common catalyst, city authorities have attempted to transform the paratransit industry. However, more often than not, the public transport restructuring has not resulted in a comprehensive substitution of existing paratransit operators. With notable exceptions, the outcome of transformational processes is a (new) hybrid system (Salazar Ferro *et al.*,

[3] Public transport integration has three main components: (1) physical or infrastructural integration; (2) fare integration; and (3) operational integration. This document focuses on this last component by studying the possibilities of paratransit operations complementing formal operations in a quest for full operations integration.

[4] Paratransit services are operating in most cities of the Global South, but their definition is not always the same. They are sometimes referred to as 'informal', even if in most cases they operate with permits issued by a regulating authority. They are a highly flexible mode of public transportation that is *de facto* unscheduled. In other cases, there is simply no pre-defined schedule. Paratransit operators provide services with a myriad of vehicle types: in some cases, vehicles can be as small as a regular car (*i.e.* collective taxis) and in some other, the paratransit sector utilises large conventional buses.

[5] In public transport systems, formal services are the counterparts of paratransit services. Formal services have usually been introduced by the government or an officially sanctioned private sector agency. Services are scheduled or frequency-controlled. They are provided by formally established operating companies or businesses (hence their definition as 'formal' services) and they have historically acted as a regulated public monopoly in terms of service provision.

2012a). Three types of hybrid systems are identified according to the role given to incumbent paratransit operators:

Type 1: Greatest recognition of the role of paratransit operators

> For this type of system, the proposed restructuring of the public transport system is based on the existing paratransit operators. Generally, the main objective of the process is the registration and formalisation of incumbent paratransit modes. Introduction (at a later stage) of a new formal service (*e.g.* a new BRT corridor) is not precluded.

Type 2: Least recognition of the role of paratransit operators

> For this type of system, transformational processes are based on the introduction of an isolated new mode, in the place of existing paratransit services. Paratransit services continue to operate outside of the corridor(s) or network(s) where the new mode was introduced. Transformation of the paratransit industry is limited to their participation in the new system.

Type 3: Late recognition of the role of paratransit operators

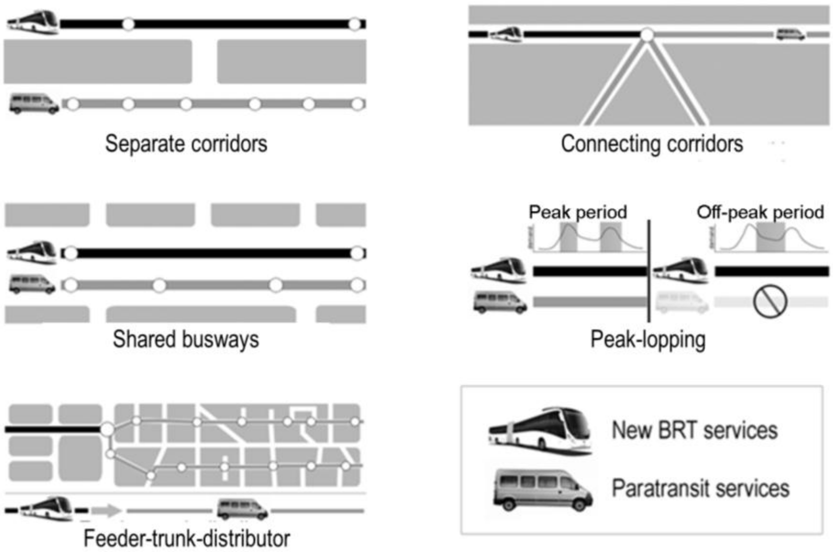
> The last type of hybrid systems refers to cities that undertook a restructuring process that initially did not give a role to paratransit operators, but that, through a significant change in the process, end up defining a substantial role of paratransit services in the new system.

Cities' processes included in type 3 (and also, conceivably, in type 2) have produced different alternatives for operational arrangements. After introducing various alternatives for integration, this study analyses the operational obstacles of engaging with the paratransit sector. The dilemma of compromising BRT operations on the one hand (if paratransit operators are included without needing to 'modernise'), or losing the typical advantages paratransit services on the other (if paratransit operators are transformed), is presented through the review of selected cases.

2. COMPLEMENTARITY ARRANGEMENTS

2.1. Complementarity alternatives

Rivasplata (2000), Sandoval (2012) and Figueroa (2012) have identified operational complementarity as one of the elements of an integrated system (the other elements are physical or infrastructural complementarity and fare complementarity). Different options to achieve operational complementarity were identified through a literature review of international experiences. Each one of these operational arrangements between formal and paratransit services has advantages and disadvantages. Five alternatives were identified (see Figure 3): (1) separate corridors; (2) connecting corridors; (3) shared roads or busways; (4) peak-lopping; and (5) feeder-trunk-distributor services (for a detailed description see Salazar Ferro *et al.*, 2012b).



Source: Authors.

Figure 3: Different operational complementarity alternatives

Alternative 1: Separate corridors

Formal and paratransit services run along different, but parallel, roads. Formal and paratransit services focus on different segments of the public transport demand; one of them providing faster direct services, while shorter trips are the responsibility of the other.

Alternative 2: Connecting corridors

Formal and paratransit services operate corridors relatively similar in hierarchy (in terms of public transport demand). These corridors function independently. Corridors are linked through a node or station where intermodal exchange happens.

Alternative 3: Shared busways

Two options are possible. First, formal and paratransit services share a road, with paratransit operating kerbside and formal services using an exclusive lane. Second, both modes share an exclusive lane.

Alternative 4: Peak-lopping

Paratransit operators are allowed, during peak-hours, on formal services' routes in order to reduce the fleet requirements of peak periods. During off-peak periods, paratransit services return to their normal routes.

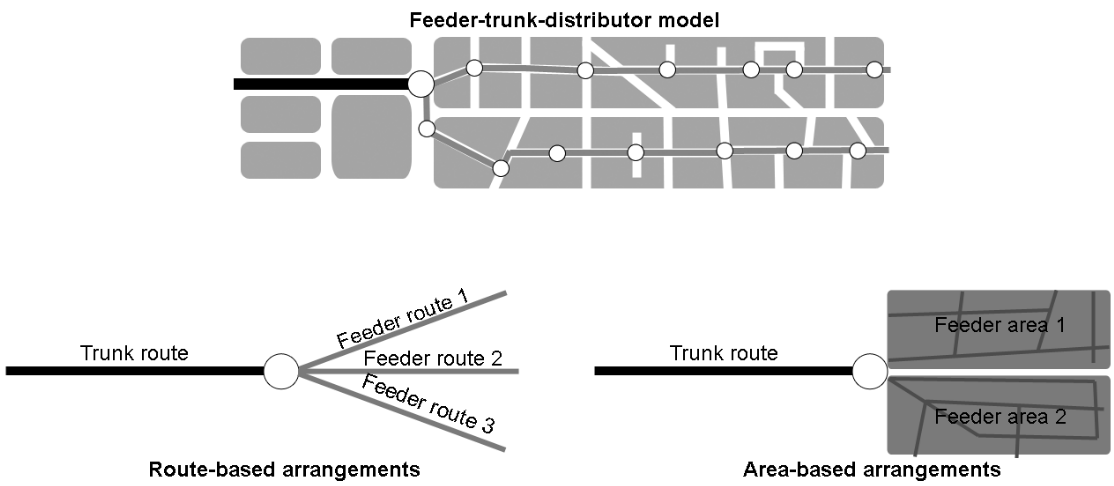
Alternative 5: Feeder-trunk-distributor (or trunk and feeder)

> Trunk services are provided by formal operators while feeder services are the responsibility of the paratransit sector. Some passenger trips are then split onto two or more different services: high-capacity services (trunk operations) and medium to low capacity services (feeder operations).

2.2. The feeder-trunk-distributor model

After an initial assessment of the prospects of achieving operational complementarity, feeder-trunk-distributor models were judged to have promise. The peak-lopping and connecting corridors alternatives are often viewed as primarily temporary arrangements; the separate corridors option remains hypothetical as such an arrangement has never been effectively implemented using formal and paratransit modes; and the shared busways alternative has a high potential to produce disruptive competition practices between formal and paratransit services. It is important to note that, even if the trunk-and-feeder alternative is preferred, this arrangement also exhibits disadvantages.

Different approaches to paratransit inclusion have been tested for the feeder-trunk-distributor model. Two possible types of arrangements to include paratransit operators as feeder service providers were identified (Figure 4).



Source: Authors.

Figure 4: Area-based and route-based arrangements of the feeder-trunk-distributor model

The first type of arrangement for achieving operational complementarity is route-based. In this arrangement pre-defined or negotiated feeder routes are awarded to paratransit operators. Most of the time, paratransit operators transport passengers to intermodal stations where feeder routes and trunk routes interchange. In order to achieve complementarity, different contracting or regulatory tools are available: route concessions with operating companies or vehicle owners, route licensing to operating companies or vehicle owners, reward mechanisms (where operators receive cash rewards for every passenger brought to the intermodal station or for every trip to and from that station), etc. Route-based arrangements may be based on single-route arrangements or on multiple-route arrangements.

The second type of arrangement is area-based. Paratransit operators are given an area in which they are responsible for providing links to trunk services and, in some instances, other services within that area. The size of the area may vary according to the urban and operational context of each city, but generally operational areas consist of several neighbourhoods. As with route-based arrangements, different tools can be put in place to achieve complementarity through area-based agreements: area concessions, franchising and, conceivably, reward mechanisms, amongst others.

Area-based arrangements require a high degree of paratransit corporatisation because contracting (or bidding processes) takes place between authorities and associations or companies that demonstrate the capacity required to operate all services within an area. In comparison, while also conceivably facilitating paratransit 'modernisation', route-based arrangements can be used by authorities to contract traditional paratransit owners or associations. In this sense, they do not require high degrees of paratransit corporatisation.

The following sections analyse two cases of route-based arrangements (Quito and Bogota) and one case of area-based arrangements (Santiago). The study identifies the complexities of engaging with the paratransit industry while highlighting the benefits of doing so. Two main scales of analysis were utilised: operational complementarity at the corridor level (*i.e.* between trunk and feeder services in the corridor) and operational complementarity between the feeder-trunk-distributor model and the rest of the public transport system.

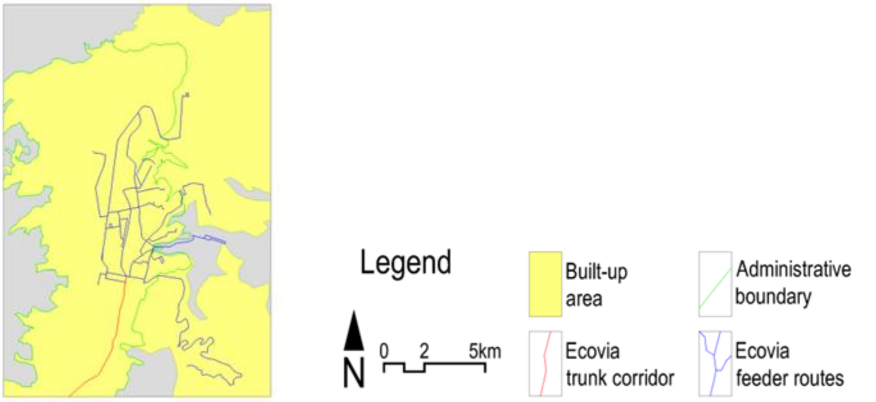
3. ROUTE-BASED ARRANGEMENTS

3.1. Single routes: Reward mechanisms in Quito, Ecuador

In Quito, Ecuador, after the implementation of a first BRT corridor in 1995 (the *Trolebús*)[6], the city attempted, in 2001, the introduction of a similar type of model for its second BRT project: *Ecovía*. In a very different approach from the one used for the introduction of the *Trolebús*, authorities opted to give existing paratransit operators a larger role by including them as operators of trunk and of feeder services (Hidalgo and Grafiteaux, 2006). This process was, however, more difficult than initially anticipated and operation of trunk services was ultimately assigned to a publicly-owned company (Hidalgo and Grafiteaux, 2006). Feeder services followed a different course, which started with an interim rewards mechanism arrangement based on route by route agreements.

[6] The *Trolebús* project was initially viewed as a prototype. One of its main objectives was to show paratransit operators that this type of planned system was viable to them and to authorities.

During the complicated process of implementing the *Ecovía* corridor, authorities devised a scheme where paratransit operators were rewarded according to the number of passengers brought to the station. Upon entering the station, and reaching a pre-defined bay, drivers were paid cash after the planning authority counted the number of passengers effectively transferring to one of *Ecovía*'s trunk services. Vehicle requirements for the formal system fleet were reduced: the feeder fleet was provided by the paratransit sector.



Source: Municipio del Distrito Metropolitano de Quito, 2009.

Figure 5: Quito's Ecovia corridor with feeder services at Rio Coca terminal station

Operationally, the rewards mechanism allowed the BRT corridor to include complementary feeder services that gave the overall system greater territorial coverage (Figure 5). The arrangement did not require route companies to fully transform to 'modern' companies. Paratransit operators included as feeder service providers were granted enough liberties to adapt their routes to the new needs of the corridor and to define frequencies and fleet numbers. This same flexibility was ultimately one of the reasons why authorities decided to exercise firmer control over feeder operations that clashed with BRT operational expectations. The rewards mechanism used during the initial phases of *Ecovía* proved to be an opportunity to include paratransit operators without requiring them to fully transform their companies. But, at the same time, due to difficulties in terms of regulating and guaranteeing adequate service provision (*i.e.* complexities of providing regular and reliable feeder services coordinated with trunk services), the rewards mechanism was one where paratransit operations and new formal operations appeared to be, sometimes, at odds.

The dependence on less reliable paratransit feeder services ultimately hampered the performance of *Ecovía*'s trunk services. Services operated on fixed timetables that were not necessarily compatible with paratransit operating practices. For example, a trunk bus could receive passengers from more than one paratransit feeder, while the next one could leave the station basically empty after no feeder service arrived prior to departure.

Ecovía's authorities ultimately decided to terminate the rewards mechanism initiative. Yet, they kept some of the features of the arrangement in later agreements with the paratransit sector. The subsequent, and still current, arrangement is a route concession model as defined by Bayliss (2002)[7]. In it, paratransit owners are given a route to operate feeder services under clearer operating terms defined by Quito's transport authority (pers. com. Castillo, 2012). Owners are paid on a monthly basis (they were previously rewarded after every trip, multiple times during one day) and they are entitled to receive more revenue if the demand on a route increases significantly (pers. com. Castillo, 2012).

At the metropolitan scale, Quito's approach to transformation has created isolated BRT corridors. *Trolebús*, *Ecovía* and, more recently, *Central-Norte* corridors are not fully integrated in terms of operations (World Bank, 2004). Moreover, in the city some paratransit companies continue operating direct services thereby creating a twofold hybrid system that is not necessarily complementary in terms of operations. First, within the BRT projects, different corridors have different arrangements with paratransit operators included in transformational processes; and, second, the grouping of BRT projects operates parallel to remaining paratransit services.

3.2. Multiple routes: Route concessions in Bogota, Colombia

Bogota's BRT implementation process drew elements from experiences on Curitiba, Santiago (regarding bidding processes with operators) and Quito (mainly from the *Trolebús* plan and the ensuing implementation) (pers. com. Figueroa, 2012). City authorities decided to introduce a major public transport initiative based on the implementation of a new public transport mode. The new BRT system, known as *Transmilenio*, uses a network of trunk services and feeder routes. All services are provided by transformed paratransit companies that now work as operating private companies.

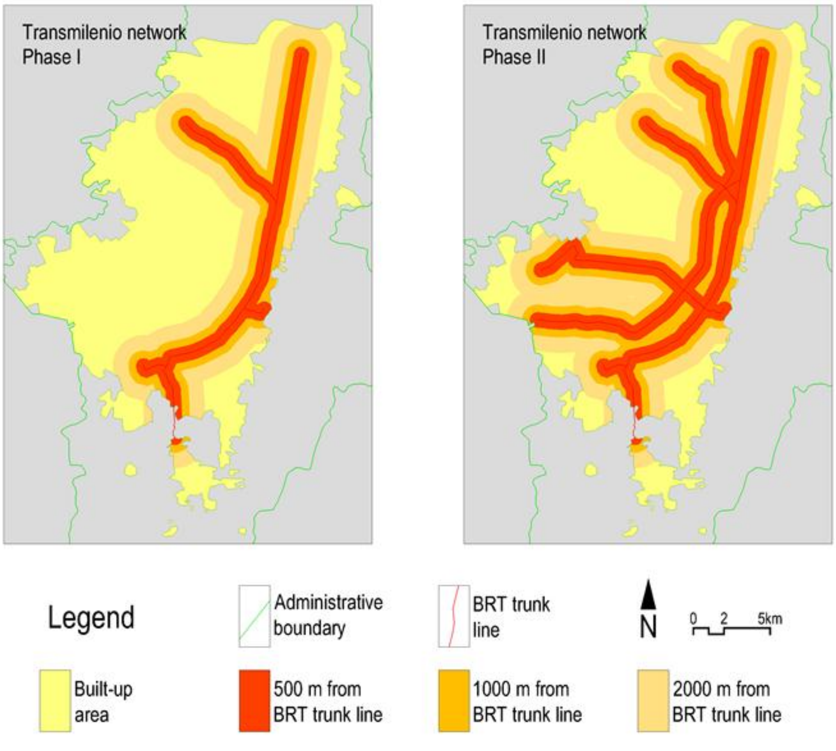
The main objective behind the negotiation with the paratransit sector was to transform their traditional companies into 'modern' operating companies (pers. com. Sandoval, 2011). The outcome was relatively successful as, after the implementation of further phases, private operating companies were transformed and they are now providing a stable service (albeit with some quality decline in recent years) on corridors where *Transmilenio* was implemented.

BRT system operations use the feeder-trunk-distributor model, clearly distinguishing between trunk and feeder services. This is reflected in different contracts for trunk and for feeder services (pers. com. Sandoval, 2012; Echeverry *et al.*, 2005). Trunk operations are gross cost contracts based mainly on the number of kilometres the company operates in the system. Feeder operations went through the process of first contracting and paying operators according to the number of passengers and, later, moving to a contract based on operated distance (pers. com. Sandoval, 2012; Echeverry *et al.*, 2005).

[7] Bayliss (2002) defines nine types of competition regulation arrangements in the public transport domain. In order starting with the arrangements that require more public funding to the ones that require less, the nine types are: (1) public monopoly; (2) management contracting; (3) gross cost service contracting; (4) net cost services contracting; (5) franchising; (6) concessions; (7) quantity licensing; (8) quality licensing; and (9) open market (Bayliss, 2002).

The feeder contracting approach did not come without problems. Initially, it allowed the newly transformed operators to use their old vehicles. One of the first phase operating companies decided to continue operating with old vehicles and, eventually, was not able to perform adequately due to vehicles breaking down often (pers. com. Sandoval, 2012), seriously hampering feeder operations in the Usme area. Ultimately, the business structure proposed required significant changes to existing paratransit companies that included fleet investments, maintenance and operations optimisation. This effectively resulted in some of the smallest operating companies being unable to participate in the process (Gilbert, 2008; Lleras E., 2005).

Bogota's public transport operational complementarity between formal and paratransit services is limited by the required transformation of existing paratransit operators and further limited to BRT intermodal terminal stations. At the urban and/or metropolitan scale, the city is relying on two distinct systems that hardly complement each other. The relationship between the BRT system and the paratransit sector is limited to a forced understanding where paratransit services do not encroach onto *Transmilenio*'s routes.



Source: Authors using Alcaldía Mayor de Bogotá, 2011.

Figure 6: Bogota's Transmilenio's phase I and phase II territorial coverage

There is a contradiction between limited paratransit inclusion and envisioned BRT area coverage. After the completion of phases 1 and 2 of the implementation programme, *Transmilenio* was responsible for approximately 20% of public transport trips; the rest (80%) is the responsibility of the paratransit system (Alcaldía Mayor de Bogotá, 2011). The mostly positive effects of *Transmilenio*'s transformation have been restricted to trunk corridors; while in the rest of the city some negative externalities (*i.e.* congestion, pollution and crash rates) have been exacerbated (Echeverry *et al.*, 2005). Because not all paratransit operators are included in the transformational process, these negative outcomes are the result of paratransit vehicles not leaving the system but moving to other corridors to continue operating (Gilbert, 2008; Ardila Gómez, 2005). If the gradual implementation of the BRT network carries on with this trend[8], *Transmilenio*'s initially envisioned area coverage could clash with the growing number of paratransit operators in other corridors (Figure 6).

4. AREA-BASED ARRANGEMENTS

4.1. Area licensing in Santiago, Chile

Before *Transantiago*'s road-based projects were implemented, Santiago's bus system had already undergone important processes of formalisation and paratransit business reform: bus services went through different processes of route licensing in the 1990s. The main objective of these initiatives was to re-introduce operational regulations to the system using a competitive tendering process and relying on existing public transport routes (Dourthe *et al.*, 1998). Forray and Figueroa (2011) argue that the paratransit-based system of the late 1990s and early 2000s provided considerable territorial coverage, more than adequate frequencies and relatively low costs. Maillet (2008) further develops the argument by stating that the main problem of the system was that authorities considered it an obstacle to public transport 'modernisation'. However, a different point of view is presented by Diaz *et al.* (2004) when they describe the bus-based system as an inefficient one.

Transantiago's restructuring initiative was based on bidding processes for, initially, five trunk operating companies and ten feeder operating companies. It was long and experienced significant problems before completion. Clashes with existing public transport operators started as early as 2002 when a 'pilot' bidding scheme was initiated. *Transantiago*'s BRT feeder-trunk model was finally implemented in 2007. The system consisted of five trunk operators in selected corridors and nine feeder operators: each one responsible for one operational feeder territorial division. Santiago's project represented a drastic citywide reform. Existing paratransit operators that were not included in the process were fully excluded from the public transport system[9].

There is a clear distinction between trunk services and feeder services in terms of what type of companies were awarded the concessions. Trunk services were given to large operating companies; of the five concessions, two were awarded to international companies and the rest to big Chilean companies, only two of which already operated in Santiago (pers. com.

[8] Recent evidence suggests that Bogota is changing its approach to transformation. In 2012, an area-based arrangement (without requiring BRT implementation) was set in motion. In this citywide initiative, some existing paratransit operators would bid for area concessions.

[9] This statement refers only to bus operators. Collective taxis in Santiago still exist independently of the BRT system.

De Cea, 2012). Feeder services were awarded to existing companies in Santiago (one of those operational contracts has since been given to an international company) (pers. com. De Cea, 2012).

The proposed model in Santiago is highly rigid in terms of operations, especially in terms of feeder service provision (Briones, 2009). Feeder buses operate in a restricted space and are not allowed to enter neighbouring operational areas (except for an 800m buffer zone). Taking into account that a move from a direct services model to a feeder-trunk-distributor model already multiplies the number of transfers, the rigidity of zones has further exacerbated the need to transfer. It has been estimated that the current rate of transfers is 11-times higher than that of the previous model (Briones, 2009).

At the metropolitan scale of the plan, operational complementarity of *Transantiago*'s feeder-trunk-distributor model was thwarted by frequencies and vehicle size issues (pers. com. Figueroa, 2012). Independent of the success or failure of the plan, the citywide operational complementarity in *Transantiago* road-based services represents a complex exercise in operational optimisation and transport engineering (Martínez Concha, 2007). It included bus fleet reductions and service frequency management (albeit currently not fully operational) that would eventually be translated into reduced externalities of the system. Nonetheless, it also resulted in the implementation of the rigid feeder-trunk-distributor model which limited or worsened accessibility on the city periphery (Jouffe and Lazo Corvalán, 2011; Briones, 2009). Inhabitants of these areas were forced to change their daily travel patterns or, more important, to modify their daily activities and movements (*e.g.* they looked for employment opportunities within walking distance or they adjusted their activity schedules to reduce their travel needs) in order to not be excluded from the city (Jouffe and Lazo Corvalán, 2010).

5. DISCUSSION: LESSONS FOR CAPE TOWN

Most current transformational processes call for the consolidation of a fragmented and dispersed paratransit sector into 'modern' operating companies responsible for trunk and feeder services of a new, more efficient, formal system. Such is the case in Cape Town (South Africa). This approach generally requires authorities to negotiate with selected individuals from paratransit companies or associations, who often that cannot claim to be representative of the wider sector (Schalekamp and Behrens, 2010).

The review of three different Latin American experiences, highlights that approaches to achieving operational complementarity between formal and paratransit services can be diverse, and that no one approach presents a readily transferable solution to another city. Approaches utilised in Quito, Bogota and Santiago also show that the level of engagement with incumbent paratransit is likely to result in different levels of operational complementarity.

5.1. Operational alternatives and dilemmas

In Quito, the rewards mechanism implemented did not solve other important operational issues in the city. When tendering for route concessions, it was difficult to include every existing operator in the arrangement. When such an alternative is implemented, it is likely that operators not included in the arrangement will continue to operate independently (*i.e.* in a non-complementary manner) and continue creating problems relating to competition in the market. Even if a modest level of operational complementarity was achieved on Quito's BRT corridors, there is an unanswered question as whether it is viable politically to engage with a limited number of operators. Conversely, the rewards mechanism created an advantageous environment for the subsequent interaction between the new 'formal' system and some incumbent paratransit operators. Notwithstanding the operational issues mentioned above, the interim solution demonstrated that arrangements without immediate and drastic transformation of the paratransit sector are possible. It resulted in a novel and more structured route-based arrangement that has proven relatively successful (pers. com. Arias, 2012).

In terms of lessons for Cape Town, the *Ecovía* experience reinforces the need for context-conscious solutions to operational complementarity between 'formal' and existing paratransit operations. The singular circumstances of the paratransit sector of Cape Town (see Schalekamp and Behrens, 2010) require transformational processes that respond to different objectives than those of other cities. It is unlikely that Cape Town's paratransit sector will achieve or easily accept the envisioned comprehensive company transformation (Schalekamp and Behrens, 2010). Thus, (interim or gradual) operational complementarity solutions that take into account the particular context and that do not require immediate operating company formation are likely to produce a more viable restructuring process.

The approach to system restructuring in Bogota has been justified by arguing that paratransit business practices clash with the business practices of *Transmilenio* (pers. com. Hidalgo, 2012; pers. com. Sandoval, 2011; Lleras E., 2005). In-corridor operational complementarity is relatively successful. But, one of the unexpected outcomes of this approach was different impacts across corridors with and without BRT services. Citywide BRT operations have been relatively successful and, during the first years, exhibited more than adequate performance. Corridors not included in the first *Transmilenio* phases however experienced worsening operating conditions (Echeverry *et al.*, 2005). Problems were deflected to roads and areas away from the trunk BRT network.

The experience of Bogota demonstrates that operational complementarity between two modes is not easy to achieve even under highly advantageous conditions. Cape Town's public transport system consists of more than two modes and operational complementarity at the metropolitan scale ideally includes rail services, formal bus services, the newly introduced BRT services and a resilient paratransit network. As a result of containing more modes, citywide operational complementarity in Cape Town is less likely to be achieved through the introduction of a single catalytic project.

In Santiago, two main and conflicting views have emerged. On one hand, some authors argue that one of the main achievements of the process has been the final formalisation of the transport industry that went from a myriad of small operators to a few large operating companies (Muñoz, 2012). Theoretically, it should mark the elimination of competition 'in the market' while it should also offer operators enough incentives to provide an adequate quality of service. This model was considered by authorities to be the base for a 'modern' and 'world-class' public transport system (Maillet, 2008). On the other hand, some authors criticise this approach to transformation and its drastic reduction in the number of operating companies. They cite the creation of small monopolies in feeder areas that undermine the quality of service (mainly with respect to coverage and frequencies) (Briones, 2009).

For Cape Town's current restructuring project, two important lessons can be drawn from Santiago's case. First, even if there is a link between the level of formalisation of incumbent paratransit operators and their possible role in the transport system, formalisation and reduction of the number of paratransit companies do not directly result in better operational complementarity. Second, the case study analysis also shows that previous dynamics and projects have an impact on subsequent initiatives. In other words, historical restructuring processes define current path dependencies that influence the outcomes and possibilities of later processes.

5.2. The complexity of transformation

Taking into account the political imperatives and the obstacles, the task of including paratransit services in public transport restructuring projects is complex. Any transformation of paratransit operators comes with dilemmas. In Quito, in order for authorities to achieve adequate regulation of operations in feeder services, owners were asked to agree to a contract that did not exist before. For trunk operations, paratransit associations were required to transform from the outset and this led to significant obstacles during implementation. In Bogota, the inclusion of a limited number of transformed paratransit operators had different effects on different parts of the overall public transport system, depending on whether or not the new formal services were introduced. In both cities, two separate and relatively isolated systems can be identified: a formal feeder-trunk-distributor set of corridors, and a paratransit based system operating outside BRT corridors. A more rigid citywide implementation process can be observed in Santiago; in it, paratransit operators not compliant with the demands of *Transantiago* were left out of the process without this necessarily resulting in greater operational complementarity.

Cape Town's current public transport restructuring process has confronted serious obstacles when engaging with incumbent paratransit operators (Schalekamp and Behrens, 2010). Of the four phases of BRT implementation initially proposed in 2007[10], at the time of writing, the *MyCiTi* network was composed of one trunk corridor and four feeder services. It is only a part of the entire Phase I. This initial implementation focused on a corridor with a low number of

[10] Initially expected to be completed within 10 to 12 years, recent evidence suggests that the four initial phases would not be completed before 2030.

paratransit route associations when compared to other corridors. It is argued that future phases of the BRT project will require considerable efforts to engage with the remaining minibus-taxi industry. It is vital to define the level of engagement of paratransit services in future phases and, equally important, the degree of paratransit companies' transformation that suits Cape Town's context.

The current engagement process with operators was longer and more complex than initially expected resulting in delays in implementation and changes to the initial proposal. Considering that future corridors might pose bigger challenges because of the number of affected paratransit associations is larger, it is argued that a novel and context appropriate approach to paratransit transformation will be required to ensure the success of the restructuring plan.

Finally, independent of what type of arrangement and what tools are utilised to achieve operational complementarity, benefits to including existing paratransit operators in restructuring projects exist. The more commonly mentioned advantages of paratransit services are their flexibility and demand responsiveness (Cervero and Golub, 2007) in cities of the Global South that are changing relatively rapidly in structure and shape.

CONCLUSIONS

The first and most important policy advice that stems from the case studies presented in this document is that ready-made solutions will not solve urban public transport problems, and that there is no one standard solution to be implemented. Indeed, the key implication is that each city's planning authority needs to consider its own urban context and acknowledge paratransit path dependencies, and it needs to propose an original programme with clear aims. The review of cases demonstrates that processes are not transferable; that the same programme will yield different results in different cities. Moreover, it is also concluded that transformational programmes need to be flexible and cater for expected and unexpected modifications to the initial plan when obstacles, mainly associated with engaging with incumbent operators, arise.

The review of different cases highlights the need to recognise paratransit as an important part of the public transport systems of most cities in the Global South, and the dilemma associated with including paratransit operators as service providers in a complementary hybrid system. In feeder-trunk-distributor models, on the one hand, including paratransit operators without requiring a high degree of corporatisation hinders formal operations as feeder services frequencies and reliability are not guaranteed within this framework. At the same time, these same paratransit services maintain their advantages of flexibility and demand responsiveness, elements that can be beneficial to the transport system. On the other hand, when requiring higher levels of corporatisation, most of these paratransit services' advantages will erode but a firmer control over frequencies and reliability of feeder services is easier to achieve. No one answer proves to be an easily transferable approach to operational complementarity as a step towards an integrated system.

Operational complementarity, under current restructuring processes that include a BRT system as a catalyst, consists of two different but not independent scales. First, at a corridor scale, most initiatives rely on a feeder-trunk-distributor model where complementarity is proposed between feeder services and trunk services. Feeder services are viewed as operations that can run with less restrictions or controls; this is then reflected in the type of engagement with paratransit companies. Trunk services are considered to require higher quality services and more reliable operations. Therefore, in terms of engaging with paratransit companies, to award feeder services to incumbent paratransit operators appears more appealing to authorities; while for trunk services, authorities tend to limit the inclusion of (traditional) paratransit companies. This split between trunk and feeder operations increases the complexity of achieving operational complementarity within a corridor. Conceptually, feeder and trunk services are considered as isolated operations and, as a result, they require more efforts to achieve operational complementarity than if feeder and trunk services were considered to be a single operation.

At the corridor level, even if these issues are not directly addressed in this document, fare integration and physical integration will complement operational complementarity to achieve a fully integrated system. Trunk and feeder models require infrastructural elements (*i.e.* intermodal stations where users can transfer from formal to paratransit services and *vice versa*) to be in place. Infrastructural elements should be conceived according to the complementarity arrangement that was selected and should, ideally, be flexible enough to allow for eventual modifications to the initial scheme.

Fare integration in formal-paratransit arrangements poses important questions. Indeed, fare integration in current BRT-based plans is often associated with gross cost contracting for trunk and for feeder services. Gross cost contracting inherently requires a corporatisation of paratransit operators that can mean the full transformation of previously paratransit operators into formal operators. The review of experiences presented in this document shows, however, that other forms of fare integration or fare complementarity between a formal mode and a paratransit one are possible and that such forms should be devised according to the desired operational complementarity of the system. Paratransit feeder services can benefit from original and context-conscious fare mechanisms that do not undermine flexibility and demand-responsiveness. Gross cost contracting could require a level of corporatisation that is not easily attainable in the first phases of transformation.

The second scale of operational complementarity is the citywide or metropolitan scale, where newly implemented BRT networks coexist with other modes. In this case, BRT systems are one more mode of the public transport system and not necessarily the main mode (as is the case at the corridor scale). As such, operational complementarity at the citywide scale between BRT and other modes is not the sole responsibility of the new system. To successfully achieve operational complementarity (as an element of integration) through only catalytic projects is likely to be unrealistic.

Successful complementarity at the corridor scale is a necessity to achieve citywide complementarity but it does not guarantee success at this latter scale. Furthermore, feeder-trunk-distributor model implementation is not suitable for every context and it requires a careful prior analysis of its implications. It is impractical to expect that an urban territory can be fully and efficiently covered using only feeder-trunk-distributor models. Yet, currently many BRT projects seem to privilege such models, thus restricting and complicating subsequent BRT service implementation. Exploration of other alternatives is in order.

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