Transport Reviews

ISSN: 0144-1647 (Print) 1464-5327 (Online) Journal homepage: https://www.tandfonline.com/loi/ttrv20

Mapping minibuses in Maputo and Nairobi: engaging paratransit in transportation planning in African cities

Jacqueline M. Klopp & Clemence Cavoli

To cite this article: Jacqueline M. Klopp & Clemence Cavoli (2019) Mapping minibuses in Maputo and Nairobi: engaging paratransit in transportation planning in African cities, Transport Reviews, 39:5, 657-676, DOI: 10.1080/01441647.2019.1598513

To link to this article: https://doi.org/10.1080/01441647.2019.1598513

Published online: 12 Apr 2019.

TRANSPORT REVIEWS
2019, VOL. 39, NO. 5, 657–676
https://doi.org/10.1080/01441647.2019.1598513

Routledge
Taylor & Francis Group

Mapping minibuses in Maputo and Nairobi: engaging paratransit in transportation planning in African cities

Jacqueline M. Klopp[a] and Clemence Cavoli[b]

[a]Center for Sustainable Urban Development, Earth Institute, Columbia University, New York, NY, USA; [b]Center for Transport Studies, University College London, London, UK

ABSTRACT

Often called paratransit because of their flexible stops, schedules and routes, minibuses make up the bulk of public transport in African cities. Despite their ubiquity and importance, these systems are poorly understood by transportation planners who tend to focus on large-scale urban infrastructure projects such as highways, commuter rail or bus rapid transit systems. The assumption within much of this planning is that these minibus systems are barriers to change and will become at most secondary "feeder" buses within large-scale projects, but structured plans detailing this vision are lacking. This paper argues that frequent failure to collect data and value important paratransit systems as a critical part of transportation in their own right is deeply problematic from the point of view of equity, access and inclusive and effective planning. We ask whether the growing number of bottom up mapping projects of minibus systems can disrupt this status quo. By comparing two mapping projects, Digital Matatus in Nairobi and the Mapa Dos Chapas in Maputo, we find that inclusive, collaborative mapping can help render these minibuses more visible in planning and provoke more grounded and inclusive "planning conversations" on multi-modal integration, passenger information and minibus upgrading, all key but relatively marginalised aspects of creating accessible, low emission, high quality and safe public transport in African cities.

ARTICLE HISTORY
Received 11 July 2017
Accepted 16 March 2019

KEYWORDS
Paratransit; minibuses; informality; Nairobi; Maputo; transportation planning; data

Introduction

Partially self-organised, market-driven bus systems form the bulk of urban transport services in African cities, moving millions daily in and between cities, towns, settlements and market centers (Behrens, McCormick, & Mfinanga, 2016). Often called paratransit, these buses can have flexible stops, schedules, fares and routes and typically involve buses carrying around 14–24 people. Although motorcycles are increasing in many places, walking and taking paratransit are the dominant modes of travel in African cities. Despite the ubiquity and importance of these paratransit systems, and the profound

CONTACT Jacqueline M. Klopp jk2002@columbia.edu Center for Sustainable Urban Development, Earth Institute, Columbia University, New York, NY, USA

impact they have on culture, daily life, employment and the economy, they are poorly understood and addressed within official transportation planning in African cities. Paratransit is frequently seen as "chaotic" and a barrier instead of a vehicle for needed public transport improvements; this is in part because it is perceived as an obstacle for implementing reform, competition for any formal system and is often embedded in complex political institutional dynamics (Khayesi, Muyia Nafukho, & Kemuma, 2015; Lomme, 2008; Woolf & Joubert, 2013).

This view of paratransit as a barrier to reform in current transportation planning in African cities is reflected in the paucity of very basic data about these systems including routes, stops, frequencies, passenger volumes, fares, ownership structures, and revenues (Klopp, Williams, Waiganjo, Orwa, & White, 2015; Williams, Waiganjo, White, Orwa, & Klopp, 2015). Such data would allow better understanding of the functioning and performance of paratransit within the overall urban public transport system. It would also help reveal how various large-scale transportation projects would impact the system that the majority of citizens rely on every day. Finally, such data allows us to measure questions of accessibility generated by different modes (Campbell, Rising, Klopp, & Mwikali, 2019) and to compare actual networks with multi-agent models of paratransit network evolution (Neuman, Roder, & Joubert, 2015; Neumann, 2014; Neumann & Joubert, 2016).

The rise and spread of geo-location enabled cellphones create new opportunities to directly map minibus systems in Africa and elsewhere closing some of the data gap (Eros, Mehndiratta, Zegras, Webb, & Ochoa, 2014; Klopp et al., 2015; Williams et al., 2015). Currently, a growing number of mapping projects are taking place. These are often started or led by local "civic hackers" to use a term from Townsend (2013). These are urban activists who leverage new technologies and novel ways to create and share data to improve cities. These activists tend to be outside of official transportation planning, which typically involves lenders, consultants and government officials. These official transportation planners are by and large engineers and economists while the civic hackers are socially minded software developers, computer scientists and urban planners. Overall, how Information and Communication Technology (ICT) innovation impacting transportation planning and vision is an important larger question especially with the emergence of ICT enabled services like Uber, real-time passenger information and discussions about moving towards mobility as a service (Klopp, 2018; Lee-Gosselin & Buliung, 2012; Van Wee, Geurs, & Chorus, 2013).

One of the earliest and best known paratransit mapping projects in Africa is the Digital Matatus project in Nairobi which led to the launch of a public transit map for the city in 2014 and the first comprehensive stop and route data for these minibus systems in the standardised General Transit Feed Specification (GTFS) format (Klopp et al., 2015; Williams et al., 2015). Since the Nairobi project, (mini) bus/paratransit mapping efforts have taken place using different tools and approaches in Accra (Saddier, Patterson, Johnson, & Chan, 2016, 2017), Kampala (Ndibatya, Coetzee, & Booysen, 2016), Cape Town, Addis Ababa, Douala, Durban, Maputo, Cairo and Lusaka (Ngoma & Shamambo, 2016), and mapping is spreading to other cities as well.

This paper asks whether these collaborative mapping projects can help encourage official transportation planning to be more inclusive of these important minibus systems and engage with them in new, more data-driven ways. We begin with an overview of some trends in transportation planning in African cities with a focus on paratransit.

Next, we briefly review existing minibus mapping projects before taking a deeper, comparative look at the Nairobi and Maputo case studies. While the Digital Matatus project (Nairobi) and the Mapa Dos Chapas project (Maputo), are at different stages, they follow a similar approach. This involves a highly inclusive and open mapping process that explicitly aims to facilitate new "planning conversations". These mapping processes also aim to improve paratransit systems and integrate them better into planning processes. Both projects also face a planning milieu that tends to avoid or ignore the question of minibus systems upgrading in favor of large-scale projects such as highway expansion and Bus Rapid Transit (BRT) with minibuses treated as secondary "feeders" rather than an integral part of a multimodal system.

Overview of transportation planning in African cities

Transportation planners in African cities include central and local government actors but also international consultants and various external lenders or "development partners". This group of transportation planners tends to focus on and promote large-scale urban infrastructure projects such as highway improvements, commuter rail or more recently Bus Rapid Transit systems (Khayesi, Monheim, & Nebe, 2010; Klopp, 2012; Mitric, 2013; Porter, 2007). The focus on highways to accommodate the growth in private motorised vehicles reflects a wider global planning imaginary and elite bias focused on automobility (Low, Low, Gleeson, & Rush, 2005; Sadik-Khan & Solomonow, 2016). However, with growing inequity and environmental concerns around air pollution and climate change, in recent years attention has been shifting towards improving public transport along with road improvements. A review of World Bank transportation lending in Africa from 1999 to 2009 notes a "steady focus on roads and traffic management, though with some road improvements meant to favor public transport" with BRT being the most recent focus (Mitric, 2013, p. 24).

Despite this shift in focus, lenders and governments are still attracted to and incentivised to focus on large-scale projects, whether highways, rail or BRT (Flyvbjerg, 2014; Klopp, 2012; Mitric, 2013). Attractions for politicians include what Flyvbjerg calls "the economic and political sublime" meaning that they prefer big projects because of the jobs, benefits for supporters, business spinoffs as well as political visibility for all involved (2014). For their part, lenders require political support and tend towards large loans. This means minibus reform usually only comes up in association with big projects like BRT. Mitric notes that within current World Bank lending there is what he calls "unfinished business" which means that even after the large-scale projects like BRT are launched, paratransit continues to provide services as part of "the remaining informal public transport market" (2013, p. 32). Indeed, as a result of this persistence of paratransit, increasing attention is being paid to paratransit integration into BRT and, to a much lesser extent, strategies for improving their services as part of multi-modal systems (Behrens et al., 2016; Jennings & Behrens, 2017).

Overall, paratransit sits uncomfortably within current official planning approaches in African cities. Research including from "master planning" surveys points to paratransit having high modal and market share and being critical to mobility and access in African cities (Behrens et al., 2016; Campbell et al., 2019; Lomme, 2008; Nell, 2018). However, many institutional, structural and political complexities, including concerns

with illegality and even violence in the sector exist around regulating these minibuses; how to engage the sector to generate improvements is challenging and not always clear (Goodfellow, 2016; Gwillam, 2008; Klopp & Mitullah, 2016; Saddier et al., 2016; Wilkinson, 2010). Finally, minibuses are often seen as competition for the more formal systems like BRT (Lomme, 2008; Woolf & Joubert, 2013). These difficulties appear to create incentives to avoid a deeper, more sustained engagement with the minibus sector despite its contribution to providing transport services in African cities.

Currently, paratransit reform tends to be addressed mainly through BRT projects, which have become popular in transportation planning in Africa through a complex process of "policy transfer" from Latin America (Wood, 2015a, 2015b). BRT is defined as "high quality bus-based public transport that delivers rapid mobility through the provision of segregated right-of-way infrastructure and rapid, and frequent operations" (Wright & Hook, 2007 cited in Gauthier & Weinstock, 2010, p. 318). It is attractive because it allows rapid improvement in mass transit capacity at relatively moderate cost compared to rail or subways (Behrens et al., 2016; Deng & Nelson, 2011). In addition, BRT is still a large-scale project with high visibility and other political economy attractions (Flyvbjerg, 2014; Rizzo, 2014).

A focus on BRT rather than urban highway construction is a step forward in transportation planning in African cities and provides an opportunity to engage with critically important paratransit systems. These BRT projects bring to the fore the need to upgrade and increase the capacity and efficiency of urban public transportation in African cities as one of the key ways to address congestion, pollution and climate change challenges. Very importantly, BRT projects also open up space to engage the existing minibus systems in a dialogue about reform and give operators and owners opportunities to become partners as well as discuss their needs (Behrens et al., 2016; Flores Dewey, 2016; Gauthier & Weinstock, 2010). Overall, then BRT is perceived by project implementers as a tool to restructure and reform paratransit systems as well as other aspects of transport governance (Flores Dewey, 2016; Paget-Seekins, 2015; Poku-Boansi & Marsden, 2018; Schalekamp, 2017).

Within this context of BRT expansion, many cities are faced with the necessity of engaging with minibuses to buy off their routes or to refashion them into critical BRT feeder systems. This involves a formalisation process, usually through regulatory reform especially around licensing and also through contracting for services around BRT (Venter, 2013). Unfortunately, much of this engagement has been "time-consuming, intensive and at times volatile" and not always very successful (Schalekamp & Behrens, 2013). With the large-scale projects in the works, many planners are focused on designs and operations and consider paratransit upgrading as secondary concern rather than a crucial element of building an integrated multi-modal public transport network wihere minibuses continue to play an important role (Behrens et al., 2016; Khayesi et al., 2015; Schalekamp, 2015).

Even after mass transit projects are completed, people are still likely to use minibuses when travelling off main corridors and, given the low density urban forms in many African cities, minibuses tend to continue to operate not only as feeders to mass transit but also as critical links in the system (Munoz-Raskin & Scorcia, 2017, 2018). Top down and "heavy handed" approaches to these vital systems in official transportation planning mean not only will interventions be less effective (Venter, 2013; Klopp & Mitullah, 2016), but also

potentially regressive, reinforcing spatial and social inequality in cities that already have severe inequality problems (Bryceson, Mbara, & Maunder, 2003; Hagans, 2011; Schalekamp, 2015). For example, higher fines for minibus infractions are often simply passed on to the consumer (Klopp & Mitullah, 2016). While engagement is difficult, the persistence and importance of paratransit to poorer segments of the population suggest engagement must continue in new, creative and contextually appropriate ways and not just within BRT projects. Some evidence exists that, at least in South Africa with the most extensive experience with minibus engagement through BRT implementation, the paradigm is shifting from "displace and replace" to "embrace, engage and upgrade" (Jennings & Behrens, 2017; Schalekamp & Klopp, 2018).

The rise of minibus mapping projects

In the process of developing a BRT plan, data on paratransit routes and revenues are important to know, and some data is collected as part of service plan. However, typically, this data does not cover the whole network but focuses on routes that will be displaced or bought out through the BRT implementation process. In addition, the data is not widely shared. For example, in Maputo's Master plan, produced by the Japan International Cooperation Agency (JICA) in 2014, only two paragraphs are dedicated to Maputo's minibus system (chapas). The plan estimates that around 60% of non-walking trips were made by chapas in 2012 (JICA, 2014, p. 5). Estimates of the number of routes (130) and vehicles (4500), are also provided, including an incomplete map (JICA, 2014, p. 5 &6). The information collected about Maputo's minibus system in the context of this master plan is limited and clearly insufficient to properly understand and integrate paratransit systems with future mass transit networks.

In contrast, a number of efforts have emerged outside of BRT and other large-scale transport projects to map out minibuses in their own right (Klopp et al., 2015; Ndibatya et al., 2016; Ngoma & Shamambo, 2016; Williams et al., 2015; Saddier et al., 2016). These mapping projects take place outside of a potentially threatening reform process and also involve outsiders to the transportation planning system including actors from technology companies like WhereisMyTransport and GoMetro to universities, city level government, NGOs and passengers. In the case of the AccraMobile project, for example, the French Development Agency supported paratransit mapping with Concordia University and the Department of Transport of the Accra Metropolitan Assembly. Initially most of these mapping projects have been "bottom up" and assume that minibuses are a de facto, legitimate part of the urban transportation system.

Mapping, of course, can have diverse impacts, not always positive (Harvey & Chrisman, 1998; Wood, 1992). Collaboration around geospatial data creates power impacts (Elwood, 2002). The idea behind bus mapping projects is to promote inclusion and proper data of these systems in planning, as well as to create passenger information services like routing apps, maps or information screens/systems. This is often driven by a concern with equity within transportation and the need to improve services for the majority of transit riders in these cities. However, data can be put to diverse agendas. Mutongi argues that in the Kenyan case, matatus are an arena of local entrepreneurship that might actually be endangered by more interaction with global capital and development intervention (2006, 2017). Rendering these systems visible thus can open the system up, not just to engagement, but

also to unwanted interventions especially as more official transport sector actors take over mapping. In contrast, some in the sector believe that without change, they will be rendered obsolete by ongoing changes in the sector from the megaprojects like BRT to technological and business disruptions like Uber, Swvl and other ride-sharing companies (Interview Nderitu 2016). Overall, then the impacts of these mapping projects need careful scrutiny.

Mapping Matatus in Nairobi

In 2011, a consortium of universities (University of Nairobi, MIT, Columbia University) and a small design firm specialising in informality (Groupshot) began using geo-location enabled cellphones and Global Positioning System (GPS) units to map the minibus (matatu) system in Nairobi. The data collection process which involved having a team of mappers from the University of Nairobi research and collect data on stops and routes for the entire system has been well documented (Klopp et al., 2015; Williams et al., 2015). This mapping project set out to engage a wide variety of actors from government, civil society and the technology and transportation sectors. It engaged with these diverse actors throughout the mapping process to get feedback and build an understanding of the data and its standardised format (General Transit Feed Specification) as well as to encourage use of the data to influence policy and planning. The project was motivated by a desire to raise the profile of public transport in Kenya where a strong focus on highway building for cars was under way without regard for the majority of people who use matatus as the main form of motorised transport (Klopp, 2012; Manji, 2015). Thus, mapping was part of a specific pro-urban public transport advocacy agenda, influenced by a growing global civic hacker movement aimed at improving passenger interaction with public transport by providing high quality information through apps and maps (Townsend 2013; McHugh, 2013).

The Kenya Institute of Public Policy Research and Analysis (KIPPRA), under the Ministry of Planning, became a key government advocate. Support came largely from a young GIS trained infrastructure specialist who saw the value of data in conducting the analysis KIPPRA provides to the Ministry of Transport and Infrastructure (MOTI). KIPPRA had also been a key player in developing Kenya's first integrated national transport policy which reinforced the need for good data (Government of Kenya, 2010). Another key government ally was the Kenyan Open Data Initiative within the Information and Communication Technology (ICT) Authority under the leadership of another young dynamic data specialist who came from Nairobi's vibrant technology community. The initiative's mandate is to make high quality data from the Kenyan government open to the public in line with the Kenyan Constitution's article 35 on the right to information. Advocates within these organisations provided informal moral support and advice. KIPPRA also hosted a number of inclusive workshops as the data was being created and the open data initiative eventually posted the data on its open data portal, helping to disseminate it.

However, government engagement was largely limited to the support of these young tech savvy technocrats. Key actors involved in transportation planning for Nairobi – the Ministry of Transport and Infrastructure (MOTI) including the National Transport and Safety Authority (NTSA) and the Nairobi City County which were together responsible for route planning were considerably more hesitant to embrace the idea of open data. Nevertheless, in January 2014, officials from the governor's office of Nairobi City County

and the Ministry of Transport and Infrastructure came to the data and public map launch. The governor of the city in particular was quick to make public pronouncements in support with language that appeared to give the city some credit for the Digital Matatus efforts. However, the actual embracing of the data by transportation planners was slow and the project operated outside of the realm of formal government support and engagement.

One key reason for this could stem from the fact that the data raises the question of which routes in the system have actually been approved by authorities. For example, an analysis of the over 3000 stops revealed that 67% of them are in fact informal or never properly designated and designed by the city which is responsible for them. Similarly, the question could be raised as to how many of the routes are actually official. The reluctance of some city planners to post the map and data as official, despite the proclamations of the governor, may stem from the desire to avoid looking like they are formalising matatu routes that remain part of a negotiated informality which benefits key and often powerful actors (Agbiboa, 2019; Klopp & Mitullah, 2016). Thus, in many ways the maps provoke important questions of responsibility for planning and regularization of the system (Figure 1).

In contrast, other actors engaged through the mapping quickly embraced the data and its visualisation as a map. This included drivers and owners who were often proud to see their routes depicted on a map and were keen to contribute to be sure data was accurate. Within the conversations with these actors about the map, enormous bitterness would emerge about the harassment and extraction of bribes from the police who "punish" any deviation of what they considered "official" routes and stops. Thus, in the view of

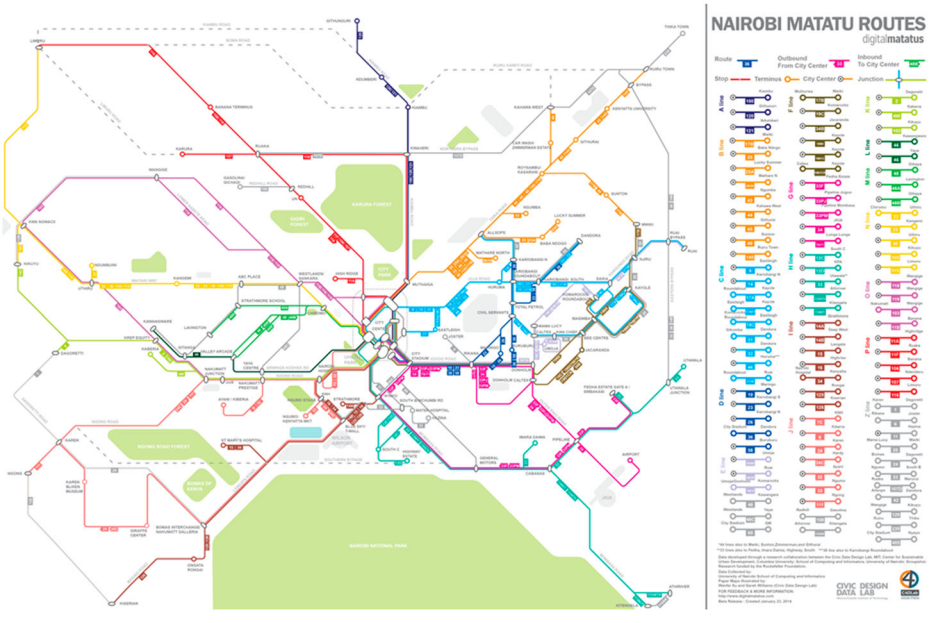

Figure 1. DigitalMatatus map of Minibus Routes in Nairobi. Courtesy: MIT Civic Data Design Lab/ DigitalMatatus.

many matatu drivers, the lack of planning and regularisation of routes and stops by the city was leading to arbitrary extraction and harassment.

The maps also opened new ways to illustrate the logics of some of the new and improvised routes which were developed from the bottom up to combat traffic congestion and create more access to services for passengers. The stylised DigitalMatatus map and data allowed more analysis of the matatu system network structure clearly showing a radial network with all major routes converging on the centre contributing – along with cars – to congestion (Figure 2). Connections cluster at the city centre, and the absence of cross-town routes means passengers must get off and walk a distance to find another matatu to cross the city which is very inefficient. An optimal network for Nairobi would have more of a grid structure and a richer spread along with an amalgamation of existing routes to run crosstown.

Transportation planner Jarrett Walker analysed the network from the DigitalMatatus map and noted that this clustering

> is a common thing that goes wrong in privately evolved systems. Every matatu wants to go downtown because it's the biggest market, and a matatu driver doesn't have to be coordinated with anyone else to fill a bus going to and from there. (Walker, 2014)

While these systems generate certain efficiencies, they do not create the best kinds of networks for the city and its residents. This suggests in the absence of mass transit infrastructure, negotiating network reorganisation, using financial support as a lever, could improve public transport significantly and be an alternative or intermediary option.

The data was also made open and available to tech entrepreneurs who were invited to the KIPPRA workshops to learn about the data structure. Some of these entrepreneurs took the data and built or added the data to their routing apps which are now available for

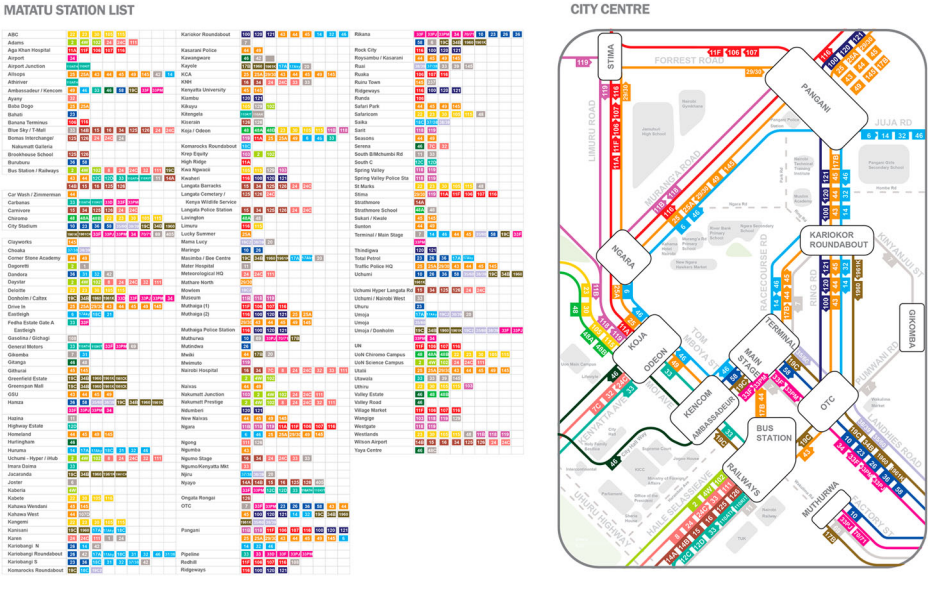

Figure 2. The DigitalMatatus Map shows the complex way that transfers must be done at the center of the City, an inefficiency emerging out of the private nature of the system Courtesy: MIT Civic Data Design Lab/DigitalMatatus

Nairobians (ma3route, transit app, matatu map). Later, the data would also be up on Google maps. At the launch of the Google transit app for Nairobi in 2015, the ICT Director for the National Transport and Safety Authority was asked by journalists who would be responsible for updating and providing this data to the public. Now that a new service was possible for citizens, this became an important question. Interestingly, in discussions with matatu drivers, we discovered that they play a critical role in providing passenger information services, something that is done by transit agencies in most cities. These drivers were keen to have ways to improve information with maps in matatus and at bus terminals and stops and hence reduce the number of questions they receive in the course of their long busy day. Matatu users also expressed their interest in having good information before they board a vehicle (Klopp et al., 2015).

It should be mentioned that the representation of the matatu system as a more formal system might have the effect of suggesting false parallels between how matatus and more formal systems operate. The use of the London Tube style for the matatu system was deliberately designed to reverse thinking about these systems that are usually seen as overly "chaotic". The map suggests that these systems have regularities and structures-otherwise they would not be able to function well and passengers would not know where to find vehicles. In the second phase of mapping, more information was collected including average fares and also perception of safety and comfort which will help reveal quality of service. In future, much more information will be collected and layered on top of this base map to give a more realistic picture of the system as a whole.

At the time, multilateral actors/lenders such as the World Bank, the European Union and the African Development Bank and their consultants, used the data and maps without, however, generally recognising a role in or responsibility for supporting the creation of such data as part of "capacity building". Besides the French Development Agency, one exception is UN-Habitat, which after engaging in a number of conversations with Digital Matatus engaged the Institute of Transportation Development Policy (ITDP) to replicate the mapping process in Kampala. Later, ITDP would get a grant to map out the Kenyan city of Kisumu. UN-Habitat and ITDP also used the digital matatus data for its BRT service plan for Nairobi, saving time and effort; in this practical way they experienced the value of high quality open minibus data for cutting the costs of transportation planning (UN Habitat and ITDP, 2015). Further, with the routes that the BRT will clearly displace or impact matatus visible, it becomes much less possible to avoid the planning conversations around how the BRT will mesh with the existing matatu system. Still, the problem of negotiating with the matatu sector and building a strong process of engagement, unfortunately, did not seem as much of a priority as the technical designs.

Mapping Chapas in Maputo

In Maputo a similar mapping project initiative, the "Mapa Dos Chapas" (minibus map) was initiated in June 2014, and gained significant insights and understanding from the experiences of the Digital Matatus project. On the one hand the project aims to give visibility to the minibus (chapas) system, the backbone of collective transport in Maputo, by collecting minibus routes and bus stops data and translating them into a user friendly map. On the other hand, it aims to generate conversations about urban mobility in Maputo and the role of the minibuses in the transport network. A team of local think tank (WAZA), academics

(based at University College London) and a local Mozambican association that supports and promotes participatory governance and citizens' advocacy (RUTH) led the process. The involvement of WAZA and RUTH was particularly important to legitimise the project and initiate bottom-up processes.

The mapping process was undertaken in close collaboration with the main paratransit associations (in particular ATROMAP). The first step of the mapping process consisted of collecting GPS coordinates of minibus routes and commonly used informal minibus stops. This data was then compiled, verified and approved by the representatives of the chapas associations. This is important, as it represents a step towards the formalisation of a structured system that until now has been primarily based on flexibility (of routes and stops) dependent on users' demand. Indeed, by agreeing and formally recognising a set of routes and bus stops during a collaborative mapping process and promoting them to the customers via the map itself, chapas owners and drivers may be more likely to adhere to the routes and stops agreed to in the context of the mapping process. As in Nairobi this raises questions about the transition to increased formality and the benefits and potential drawbacks this might generate. Overall, much as in the matatus project, the chapas association representatives view the map as an opportunity to enhance the visibility of their service and to gain recognition. As a result, they have been actively supporting the mapping project.

From an early stage, a key element of the project was the engagement with public authorities in Maputo, in particular the Maputo City Council Transport Department. The Mapa Dos Chapas team sought formal approval of the mapping process and of the map from the public authorities at the outset. After much negotiation, the Maputo city council embraced the mapping project as an opportunity to collect valuable data and have a better understanding – and potentially control – of the chapas system. At the request of Maputo's local authority, the title of the map was then changed from *Mapa Dos Chapas* to *Mapa de Transporte Publico* (*Maputo's map of public transport)* as major public bus routes and railway lines were added to the chapas map showing a more integrated picture of the system as a whole. Indeed, large public buses operate along the most popular corridors in the city along with chapas. This step also indicated the Maputo City Council's willingness to take ownership of the map, a significant milestone in the project. The final sign of official endorsement was the addition of the local city council's logo to the map (Figure 3).

Early on the draft chapas map was used as a working document by both the local authority and the chapas associations. For example, the map was helpful when new chapas routes were licensed in March 2016 and since the beginning of 2016 transport authorities in Maputo have given increased importance to the chapas system. The City Council supported the creation of a cooperative representing chapas owners, called COOTRACK1, and granted this association the right to buy 50 government buses. Public authorities appear to increasingly perceive chapas operators as important stakeholders in Maputo's mobility scene/transport system. Initial results suggest that the mapping process may have contributed to this recent change. However, the connection between these developments and the chapas mapping project requires further research.

In addition to the chapas associations and the local authorities, a range of key stakeholders were involved in the project early on, including academics from Eduardo Mondlane University, and Maputo based UN-Habitat representatives. The Mapa Dos Chapas

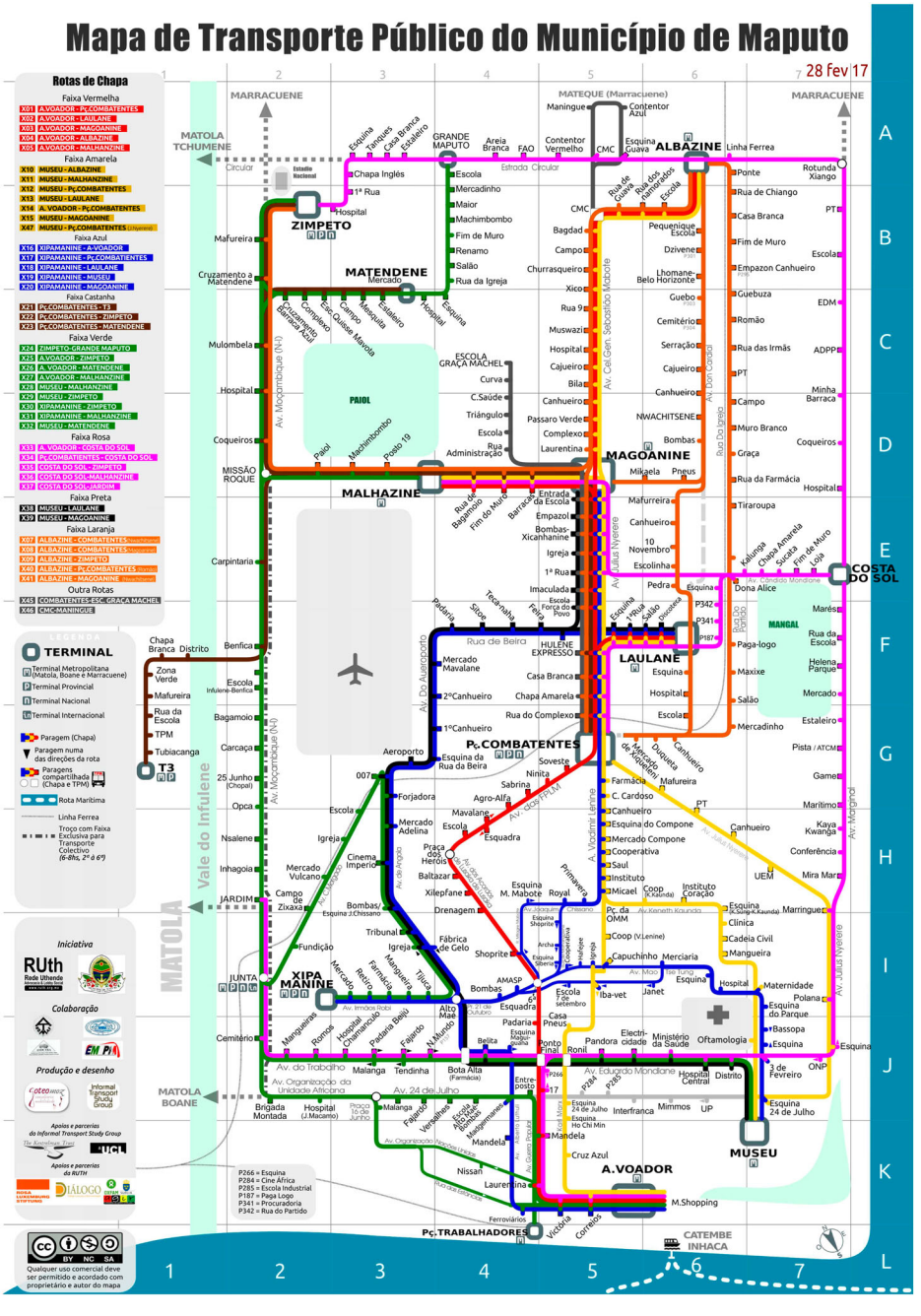

Figure 3. Mapas Dos Chapas stylised map catalysed the creation of an integrated public transport including minibus routes for Maputo.

project has generated significant interest and has drawn various stakeholders together, in particular the chapas associations, the local authority and citizens associations. Many highlight this collaboration between private and public actors as a necessary step towards an improvement in the transport system in Maputo (Mendonça, 2014; UN-Habitat, 2010).

Thus, the mapping process also becomes a way to build networks and increase coordination.

Finally, the mapping process was used as a tool to raise and discuss wider mobility issues in the city. In the context of the project, various forums and meetings have been initiated to generate exchange of ideas and discussions about the role collective transport (public and semi-formal) should play in the mobility system of the future city, in particular vis-à-vis future Mass Transit systems, such as BRT, and mobility and urban issues in the city more generally. These events and interventions were generally well received.

The beta version of the chapas map was launched in the autumn of 2016 during a transport/mobility event in Maputo. A public consultation phase followed in order to better assess and integrate users' needs into the design of the map, such as popular landmarks. Another version of the map was formally released in 2017. The project is following Digital Matatus' steps and is developing an open format version of the map based on General

Figure 4. Prototype picture bus stop Maputo. Source: Engineers without borders Maputo.

Figure 5. Maputo's map of public transport displayed by UBI in Maputo. Source: Joaquin Romero.

Transit Feed Specification (GTSF) data. The project has also entered the GPS data into OpenStreetMap (OSM). Furthermore, in 2017, the Mapa Dos Chapas team partnered with Engineers Without Borders to establish new stop infrastructure in Maputo. Maputo's map of public transport was displayed at various bus stops (See Figure 4). In 2018, a local advertising company called UBI also required permission from the project partners to showcase the map on one of their street advertising platforms (see Figure 5).

Discussion

Establishing paratransit maps in Nairobi and Maputo facilitated more open discussion about minibus routes and stops as well as demand for services. Usually such conversations happen behind closed doors between operators and the government around licensing rather than in an open planning process. Interestingly, in both cases the minibus drivers and owners did not show resistance to mapping processes once the idea was explained to them. Indeed, the mapping served to highlight their substantial local and critical knowledge to contribute to transportation planning processes. The potential benefits of discussing formalisation in this context is that the maps create an opportunity to enhance and give visibility to the extent of paratransit service which is currently buried or unavailable in statistics, master plans and academic papers.

Mapping makes elegantly clear the sheer spatial extent of the networks and the data allows for the study of access generated by this mode and how this might be improved or changed by different interventions including planned large-scale projects (Avner & Lall, 2016; Campbell et al., 2019; World Bank, 2016). It also opens up a new way to visualise the entire public transport network as it really is, as opposed to starting from the point of view of an imagined network emerging within a megaproject process that few, including the operators themselves, have information about or understand. The focus on a *public*

map or app also reinforces the focus on the passenger that gets lost in more top down mega project planning (Klopp, 2012; Venter, 2016).

Both projects highlight a more inclusionary, bottom up approach to transportation planning by involving a range of stakeholders and sharing information on an open platform which contributes to a more informed conversation. In both Maputo and Nairobi, the data gathering and mapping process have been highly collaborative involving operators, owners, policy-makers, universities, technologists and users (amongst others). This cross-sectorial collaboration is crucial to ensure the continued legitimacy and support for the data collection and to guarantee the validity of the data as well as develop institutionalised systems to keep it updated. In both cities, active support from the minibus associations has been crucial for the data gathering and the mapping process. Even if local and national governments have been slower to engage with the mapping process, they – and their consultants and finance experts – ultimately recognise the maps and data and their utility for planning.

Overall, these projects provide new, better public information about routes and stops, which in turn appears to be catalysing new conversations about networks, operations and services. This could be a promising way to engage the paratransit sector outside the shadow and logics of large infrastructure projects like BRT and more in the spirit of thinking about integrated multi-modal public transport networks. Mapping projects – both process and outcomes – might also help create a deliberative public dialogue around the sector, its needs and strategies for improvement and create new political networks and avenues to discuss, plan and implement reform. Carefully thought out mapping processes could in this way help build the kind of dialogue and negotiation that are often claimed, but not always realised, as benefits in BRT planning. This process shifts the gaze of existing planning conversations from a main focus on big projects to placing members of the minibus sector in the center of a conversation about what transit actually works for the majority of people and where it might be improved and how. This, of course, has wide relevance to most of Africa's smaller cities and towns where large transport infrastructure projects are not likely in the near term but where service improvements are also needed.

One commonly cited benefit to the minibus sector of large projects like BRT is the transfer of new technologies such as dedicated bus lanes or electronic ticketing (Venter, 2013). However, we see through these mapping projects that some technological improvements of the sector are possible quite independently of the large expensive projects. For example, building real time passenger information on growing standardised data for minibuses and at the same time for bus companies, BRT and rail, could trigger more cooperation and could improve passengers' ability to navigate throughout a network, reducing unproductive waiting times and potentially making public transport more appealing to diverse riders. It could also allow for better monitoring and planning of service improvements that will ultimately determine the success, not only of mass transit, but of the public transport system as a whole in the face of growing motorisation with all its problematic impacts for cities and people.

Understanding more deeply how mapping projects like Digital Matatus and Mapas dos Chapas are impacting public transport and transportation planning in African cities remains an important question for further research. More investigation is needed to ascertain the extent to which open, standardised data and maps and routing apps are useful for

local users in African cities and if so, in which ways. Evidence is growing in the United States and Europe that high quality open, standardised data and the routing information it allows help improve navigating, enable more efficient trips and create a different, more positive relationship between public transport, authorities and passengers (Schweiger, 2015; Shaheen, Martin, Cohen, Musunuri, & Bhattacharyya, 2016). So far, however, little work has been done in Africa on this important area of research. In addition, we might explore more systematically to what extent mapping paratransit routes and stops contributes to better recognition of this important mode and helps spur new more inclusive ways towards formalisation of paratransit systems and, in turn, whether this can help lead to more holistic planning around better integrated, multi-modal systems. Most importantly, work is also showing the utility of base GTFS data with passenger counts for better understanding the operations and business models of these systems and ways that they could be improved while at the same time improving passenger experience (Plano, Behrens, & Zuidgeest, 2018; Saddier & Johnson, 2018).

Finally, as mapping projects spread, a shift is occurring within multi-lateral and bi-lateral institutions which provide advice and fund many of the transportation infrastructure projects in African cities. For example, Nairobi's matatu data along with open land use data (Williams, Marcello, & Klopp, 2014) was used by the World Bank to produce accessibility maps for Nairobi (Avner & Lall, 2016; World Bank, 2016). The overall importance of this kind of data for accountability in transportation planning by enabling better measurement of the impact of projects and interventions on the system as a whole including on access is gaining recognition. The World Bank is now requiring accessibility analyses for all the cities where it works in Africa which, in turn, requires the creation of data for minibus systems. The French Development Agency is also increasingly requiring minibus data collection as part of its transport loans. A new "DigitalTransport4Africa.org" initiative spearheaded by the French Development Agency and Digital Matatus and other mapping collectives and joined by the World Bank is working to scale up these mapping efforts and promote open data and sharing, open source tools and exchange and learning between African cities to build local data infrastructure, eco-systems and local capacities. These policy shifts, which are helping improve understanding of minibus systems within the planning process, have emerged out of the positive experiences of mapping in Nairobi, Maputo, Accra, Cairo and elsewhere as well as important concerns around who controls public transport data especially in light of the growing number of private sector mobility and technology companies in African cities.

Conclusions

All indications suggest that Africa's minibus sector is likely to be a core part of public transport networks well into the future (Behrens et al., 2016; Ferro, Behrens, & Wilkinson, 2013; Hart, 2016; Khayesi et al., 2015; Mutongi, 2017; Rizzo, 2017; Tichagwa, 2016). Improving paratransit systems by optimising their networks, upgrading their service, improving labor conditions and integrating them better into the overall public transport network presents an opportunity for African cities to reduce unnecessary car use by creating more mobility options whilst better responding to the needs of the majority and enhancing equity and access. Providing high quality public transport alternatives is crucial to reducing emissions and the range of undesirable side-effects linked to high levels of motorised

traffic. Rather than focus primarily on megaprojects-highway expansion, BRT and rail, transportation planning in African cities will also need to embrace and work better with paratransit regardless of the difficulties and complexities. It is thus critical that we explore new ways to engage with paratransit within planning (Jennings & Behrens, 2017; Schalekamp & Klopp, 2018).

As we have shown in Maputo and Nairobi, inclusive and collaborative minibus mapping and the creation of open, standardised data is one way to start practically and conceptually engaging paratransit along with other key actors in a more grounded, coordinated, open, inclusive, and integrated transportation process. At the same time this data enables new, tangible tools for passengers, operators and planners. This will become even more important as urban planners move away from a focus on achieving large transport projects towards more integrated multi-modal systems that generate access and equity. If we are to reach the Urban Sustainable Development Goal target of "access to safe, affordable, accessible and sustainable transport systems for all" (United Nations, 2015), we can no longer afford to have poor data and understandings of the minibus systems, systems that the majority in African cities rely on to access the city and its opportunities.

Acknowledgements

We would like to give special thanks to Joaquin Romero de Tejada who coordinates the Maputo project locally, undertook the fieldwork in Maputo and provided data and valuable comments on this paper. We would also like to thank the Kestrelman Trust; their support has been key to the Maputo project. This paper would also not be possible without the work of the Digital Matatus team along with the many students at the University of Nairobi and MIT who helped in the mapping work over the years.

Disclosure Statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by Volvo Research and Educational Foundations [grant number EP -2017-02-MAC-CSUD]; Kestrelman Trust.

References

Agbiboa, D. (2019). Introduction. In D. Agbiboa (Ed.), *Transport, transgression and politics in African cities* (pp. 1–16). London: Routledge.

Avner, P., & Lall, S. (2016). *Matchmaking in Nairobi: The role of land use*. Policy Research working paper, No. 7904. World Bank, Washington, DC. https://openknowledge.worldbank.org/handle/10986/25803 License: CC BY 3.0 IGO

Behrens, R., McCormick, D., & Mfinanga, D. (2016). *Paratransit in African cities*. New York, NY: Routledge.

Bryceson, D. F., Mbara, T. C., & Maunder, D. (2003). Livelihoods, daily mobility and poverty in sub-Saharan Africa. *DF Transport Reviews*, *23*(2), 177–196.

Campbell, K., Rising, J., Klopp, J. M., & Mwikali, J. (2019). Accessibility across transport modes and residential types in Nairobi. *Journal of Transport Geography*, *74*, 77–90.

Deng, T., & Nelson, J. D. (2011). Recent developments in Bus rapid transit: A review of the Literature. *Transport Reviews*, *31*(1), 69–96.
Elwood, S. (2002). GIS and collaborative urban governance: Understanding their implications for community action and power. *Urban Geography*, *22*(8), 737–759.
Eros, E., Mehndiratta, S., Zegras, C., Webb, K., & Ochoa, M. C. (2014). Applying the general transit feed specification (GTFS) to the global south: Experiences in Mexico city and beyond. *Transportation Research Record*, *2442* , 44–52.
Ferro, P. S., Behrens, R., & Wilkinson, P. (2013). Hybrid urban transport systems in developing countries: Portents and prospects. *Research in Transportation Economics*, *39*, 121–132.
Flores Dewey, O. (2016). BRT as a tool for negotiated re-regulation. In Juan Carlos Munoz & Laura Paget-Seekins (Eds.), *Restructuring public transport through bus rapid transit* (pp. 51–72). London: Policy Press.
Flyvbjerg, B. (2014). What you should know about megaprojects and why: An overview. *Project Management Journal*, *45*(2), 6–19.
Gauthier, A., & Weinstock, A. (2010). Africa: Transforming paratransit into BRT. *Built Environment*, *36*(3), 317–327.
Goodfellow, T. (2016). 'Double capture' and de-democratisation: Interest group politics and Uganda's transport mafia'. *The Journal of Development Studies*. Retrieved from http://www.tandfonline.com/doi/full/10.1080/00220388.2016.1214722
Government of Kenya. (2010). *The national integrated transport policy: Moving a working nation*. Nairobi: Government Printers.
Gwillam, K. (2008). Bus transport: Is there a regulatory cycle? *Transportation Research Part A: Policy and Practice*, *42*(9), 1183–1194.
Hagans, C. (2011). *Livelihoods, location & public transport: opportunities for poverty reduction and risks of splintering urbanism in Nairobi's spatial planning*. Retrieved from https://www.bartlett.ucl.ac.uk/dpu/metrocables/dissemination/Hagans-2011.pdf
Hart, J. (2016). *Ghana on the go: African mobility in the age of motor transportation*. Bloomington: Indiana University Press.
Harvey, F., & Chrisman, N. (1998). Boundary objects and the social construction of GIS technology. *Environment and Planning A*, *30*, 1683–1694.
Jennings, G., & Behrens, R. (2017). *The case for investing in paratransit: Strategies and regulation and reform*. Volvo Research and Education Foundations. May 2017.
JICA. (2014). *Comprehensive urban transport master plan for the Greater Maputo*. Final Report, Japan International Cooperation Agency.
Khayesi, M., Monheim, H., & Nebe, J. M. (2010). Negotiating "streets for all" in urban transport planning: The case for pedestrians, cyclists and street vendors in Nairobi, Kenya. *Antipode*, *42*(1), 103–126.
Khayesi, M., Muyia Nafukho, F., & Kemuma, J. (2015). *Informal public transport in practice*. Surrey: Ashgate Publishing.
Klopp, J. M. (2012). Towards a political economy of transportation policy and practice in Nairobi. *Urban Forum*, *23*(1), 1–21.
Klopp, J. M. (2018). *Visualizing popular transport*. Developing Urban Futures LSE Cities: 14–16. Retrieved from https://lsecities.net/wp-content/uploads/2018/11/Developing-Urban-Futures-Urban-Age-conference-newspaper.pdf
Klopp, J. M., & Mitullah, W. (2016). Politics, policy and paratransit: A view from Nairobi. In R. Behrens, D. McCormick, & D. Mfinanga (Eds.), *Paratransit in African cities* (pp. 79–98). London: Routledge.
Klopp, J. M., Williams, S., Waiganjo, P., Orwa, D., & White, A. (2015). Leveraging cellphones for wayfinding and journey planning in semi-formal bus systems: Lessons from Digital Matatus in Nairobi. In *Planning Support Systems and Smart Cities* (Springer) in conjunction with the conference Computers in Urban Planning and Urban Management April 2015 MIT.
Lee-Gosselin, M., & Buliung, R. (2012). The role of ICTs in the transformation of the experience of travel. *Transportation*, *39*, 873–876.
Lomme, R. (2008). *Should South African minibus taxis be scrapped? Formalizing informal urban transport in a developing country*. CODATU XIII Conference Proceedings.

Low, N., Gleeson, B., & Rush, E. (2005). A multivalent conception of path dependence: The case of transport planning in metropolitan Melbourne, Australia. *Environmental Sciences*, *2*(4), 391–408.
Manji, A. (2015). Bulldozers, homes and highways: Nairobi and the right to the city. *Review of African Political Economy*, *42*(144), 206–224.
McHugh, B. (2013). Pioneering open data standards: The GTFS Story. In B. Goldstein & L. Dyson (Eds.), *Beyond transparency: Open data and the future of civic innovation* (pp. 125–135). San Francisco: Code for America Press.
Mendonça, I. N. (2014). Mobilidade urbana na área metropolitana de Maputo: análise dos órgãos de gestão do planeamento e mobilidade urbana, arranjos institucionais e insumos para a sua efectiva articulação. *Journal of Transport Literature*, *8*(2), 244–270.
Mitric, S. (2013). Urban transport lending by the World Bank: The last decade. *Research in Transportation Economics*, *40*, 19–33.
Munoz-Raskin, R., & Scorcia, H. (2017). Time for a Tailored Approach to South African BRTs. *Connections*, 2017-2. Washington, DC: World Bank.
Munoz-Raskin, R., & Scorcia, H. (2018). Why are South African cities different? Comparing Johannesburg Rea Vaya Bus Rapid Transit System with its Latin American siblings. Transportation Research Board 97th Annual Meeting Transportation Research Board, Washington DC.
Mutongi, K. (2006). Thugs or entrepreneurs? Perceptions of Matatu operators in Nairobi 1970 to the present. *Africa*, *76*(4), 549–568.
Mutongi, K. (2017). *Matatu: A history of popular transportation in Nairobi*. Chicago, IL: Chicago University Press.
Ndibatya, I., Coetzee, J., & Booysen, M. J. (2016, July 4–7). *Mapping the informal public transport network in Kampala with smartphones: Making sense of an organically evolved chaotic system in an emerging city in Sub-Saharan Africa*. Paper presented at the 35th Annual Southern African Transport Conference, Pretoria.
Nell, A. (2018). Evaluating transportation in the Gauteng City Region (NYU Unpublished Paper).
Neuman, A., Roder, D., & Joubert, J. W. (2015). Toward a simulation of minibuses in South Africa. *Journal of Transport and Land Use*, *8*(1), 137–154.
Neumann, A. (2014). A paratransit-inspired evolutionary process for public transit network design (Unpublished PhD thesis). Technical University, Berlin.
Neumann, A., & Joubert, J. W. (2016). The "minibus" contribution. In A. Horni, K. Nagel, & K. W. Axhausen (eds.), *The multi-agent transport Simulation MATSim* (pp. 111–114). London: Ubiquity Press. doi:10.5334/baw.17.License:CC-BY4.0
Ngoma, S., & Shamambo, P. (2016). The Zed Transit Mapping Project: Open public transit data for better city navigation (unpublished BA thesis). University of Zambia. Department of Computer Sciences.
Paget-Seekins, L. (2015). Bus rapid transit as a neoliberal contradiction. *Journal of Transport Geography*, *48*, 115–120.
Plano, C., Behrens, R., & Zuidgeest, M. (2018). Towards a stated choice methodology to determine minibus-taxi driver willingness to provide off-peak feeder service. 37th Paper presented to the Annual Southern African Transport Conference.
Poku-Boansi, M., & Marsden, G. (2018). Bus rapid transit systems as a governance reform project. *Journal of Transport Geography*, *70*, 193–202.
Porter, G. (2007). Transport planning in sub-Saharan Africa. *Progress in Development Studies*, *7*(3), 251–257.
Rizzo, M. (2014). The political economy of an urban MegaProject: The bus rapid transit project in Tanzania. *African Affairs*, *114/455*, 249–270.
Rizzo, M. (2017). *Taken for a ride: Grounding neoliberalism, Precarious labor and public transport in an African Metropolis*. Oxford: Oxford University Press.
Saddier, S., & Johnson, A. (2018). *Understanding the operational characteristics of paratransit services in Accra, Ghana: A case study*. Paper presented at the Transportation Research Board 95rd Annual Meeting.

Saddier, S., Patterson, Z., Johnson, A., & Chan, M. (2016). Mapping the jitney network with 14 smartphones in Accra, Ghana: The Accramobile experiment. *Transportation Research Record: 15 Journal of the Transportation Research Board*, (2581), 113–122.

Saddier, S., Patterson, Z., Johnson, A., & Wiseman, N. (2017). *Fickle or flexible? Assessing paratransit reliability with 2 smartphones in Accra, Ghana*. Paper presented at the Transportation Research Board 94rd Annual Meeting.

Sadik-Khan, J., & Solomonow, S. (2016). *Street Fight*. New York, NY: Viking Press.

Schalekamp, H. (2015). Paratransit operators' participation in public transport reform in Cape Town: a qualitative investigation of their business aspirations and attitudes to reform (unpublished PhD). University of Cape Town.

Schalekamp, H. (2017). Lessons from building paratransit operators' capacity to be partners in Cape Town's public transport reform process. *Transportation Research Part A: Policy and Practice*, *104*, 58–66.

Schalekamp, H., & Behrens, R. (2013). Engaging the paratransit sector in Cape Town on public transport reform: Progress, process and risks. *Research in Transportation Economics*, *39*, 185–190.

Schalekamp, H., & Klopp, J. M. (2018). *Beyond BRT: Innovation in minibus-taxi reform in South African cities*. 37th Southern African Transport Conference 9–12 July 2018.

Schweiger, C. (2015). *Open data: Challenges and opportunities for transit agencies*. Washington, DC: National Academies Press.

Shaheen, S., Martin, E., Cohen, A., Musunuri, A., & Bhattacharyya, A. (2016). *Mobile apps and transportation: A review of smartphone apps and a study of user response to multimodal traveler information*. Report for California Department of Transport. Retrieved from https://escholarship.org/uc/item/6m332192

Tichagwa, C. G. (2016). Unlicensed taxis in Zimbabwe's urban areas: The case for legalizing the informal urban transportation system. *Development Southern Africa*, *33*(1), 81–98.

Townsend, A. (2013). *Smart cities: Big data, civic hackers, and the quest for a New Utopia*. New York, NY: WW Norton & Company.

UN-Habitat. (2010). UN-Habitat Mozambique Cities Profile.

UN-Habitat and ITDP. (2015). Nairobi Ndovu/A104 BRT Service Plan. Retrieved from https://www.itdp.org/wp-content/uploads/2015/02/Nairobi-Ndovu-A104-BRT-Service-Plan.pdf

United Nations. (2015). *Goal 11: Make cities inclusive, safe, resilient and sustainable*. Retrieved from http://www.un.org/sustainabledevelopment/cities/

Van Wee, B., Geurs, K., & Chorus, C. (2013). Information, communication, travel behavior and accessibility. *The Journal of Transport and Land-use*, *6*(3), 1–16.

Venter, C. (2013). The lurch towards formalization: Lessons from the implementation of BRT in Johannesburg, South Africa. *Research in Transportation Economics*, *39*, 114–120.

Venter, C. (2016). *Are we giving passengers what they want? User preference and market segmentation in Johannesburg*. Proceedings of the 35th Southern African Transport Conference (SARC 2016).

Walker, J. (2014). The evolution of logic in privately planned transit. Human Transit Blog. Retrieved from https://humantransit.org/2014/02/the-evolution-of-logic-in-developing-world-transit.html

Wilkinson, P. (2010). The regulatory cycle stalled? An assessment of current institutional obstacles to regulatory reform in the provision of road-based public transport in Cape Town. *Africa. Research in Transportation Economics*, *29*, 387–394.

Williams, S., Marcello, E., & Klopp, J. M. (2014). Open source Nairobi: Creating a GIS Database for the city of Nairobi to provide Equal access to information. *Annals of the Association of American Geographers*, *104*(1), 114–130.

Williams, S., Waiganjo, P., White, A., Orwa, D., & Klopp, J. M. (2015). The Digital Matatu project: Using cellphones to create open source data for Nairobi's semi-formal Bus system. *Journal for Transport Geography*, *49*, 39–51.

Wood, A. (2015a). The politics of policy Circulation: Unpacking the relationship between South African and South American cities in the Adoption of Bus rapid transit. *Antipode*, *47*(4), 1062–1079.

Wood, A. (2015b). Multiple temporalities of policy circulation: gradual, repetitive and delayed processes of BRT adoption in South African cities. *International Journal of Urban and Regional Research*, *39*(3), 568–580.

Wood, D. (1992). *The power of maps*. New York, NY: Guilford.
Woolf, S. E., & Joubert, J. W. (2013). A people-centred view on paratransit in South Africa. *Cities (London, England)*, *35*, 284–293.
World Bank. (2016). *Kenya Urbanization review*. Washington, DC: World Bank. https://openknowledge.worldbank.org/handle/10986/23753 License: CC BY 3.0 IGO
Wright, L., & Hook, W. (2007). *Bus rapid planning Guide* (3rd ed.). New York, NY: ITDP.