

IS INFORMAL TRANSPORT FLEXIBLE?

LABOUR, ORGANIZATION AND PLANNING IN AFRICAN CITIES

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ABSTRACT

Informal transport is often described as flexible, reactive, demand responsive, niche-filling and in-tune with passenger needs. This paper interrogates the uses and meanings of these descriptors in planning and research, and argues that there is limited evidence to justify them, certainly as a universal characteristic. This paper together surveys and interviews of transport workers and regulators in four African cities, with the available evidence in the informal transport literature and theory, to make a different case.

Informal transport, in many circumstances, is slow and stubborn to change compared to the pace of growth of the cities it operates in, and the existing patterns are often limited in distribution, oriented to mass markets and serve relatively narrow slices of the population at a high cost of money, time, safety and dignity. These are captive audiences with little ability to influence service patterns, much less large sections of the population for whom services are geographically irrelevant or financially out of reach. Flexibility, where evinced, is often in short term, erratic search behavior that is inefficient in itself and shows little evidence at consistently keeping pace with passenger needs.

Informal systems do have mechanisms for changing their planning and routing. However, this is thanks to active and powerful association, organization, political engagement and institution building on the part of informal transport workers and operators, who, collectively, are acting as transport planners in the cities in which they operate. It is not through individual, *lassiez-faire* competition guided by the invisible hand, *nor* through romantic, colonial notions of intuitive operation according to formless and de-politicized 'local knowledge.'

INTRODUCTION

Informal transport is often assumed to be flexible, and operations are described as reactive, adaptive, agile, niche-filling and demand-responsive. How this is determined, and how it affects policy and planning, remains poorly characterized. The *geography* of informal transport in particular has received little attention. While the ability to reach destinations is affected by price, knowledge, dis/ability, safety and more (Lucas, 2011), the geography, frequency, reliability and hours of operations of transit routes are the foundation these are built on. Issues of safety, dignity, disability and gender inclusion are gradually receiving increased scrutiny, but the question of geography remains oddly underexplored, despite being the key component of accessibility.

While informal transport - independently owned vehicles operating without subsidy across cities of the global south - may be one of the most important forms of public transport globally, it remains poorly understood and marginalized in academic and policy discourse (Behrens et al., 2015; Cervero & Golub, 2007).

Flexibility has long been described as characteristic of informal transport, and the term is ubiquitous in academic and policy literature. In a 1978 overview, "the key concepts appear to be flexibility and responsiveness" and "they exploit quickly all demand situations. The operators are immediately aware of new patterns, and they can step in at a moment's notice" (Grava, 1978). Golub and Cervero (2007) write "...complementing regular transit services, entering neighborhoods poorly served by formal operators, and responding promptly to shifting market demands", and argue that informal operators are able to be profitable because they "respond quickly to changing markets and are in-tune with their passenger's demands". In Sub-Saharan African cities, "the advantages of minibuses are their agility...flexibility of fares and schedules...ability to rapidly respond to changes in demand" (Kumar & Barrett, 2008), and they are "relying on adaptability, flexibility, important territorial coverage and demand-responsiveness." (Stucki, 2015).

Reactivity is assumed to be a product of free competition for passengers across the city by individual vehicles, each motivated to pick up and deliver as many people as possible. While regulation, and self-regulation of informal transport operators often includes route licenses, set fares and fees for market entry, definition of routes by authorities, or by operators are less common. The reactivity assigned to informal transport operations should therefore be considered primarily as a *spatial* reactivity. The less regulated, and more competitive a system is, the more 'nimble' and 'flexible' it is in its ability to connect passengers to their desired destinations (Cervero, 2000).

However, this paper makes a different argument – organization and regulation among transport operators does not merely limit the negative externalities of competition.

Greater degrees of organization allow the creation of more responsive, varied, widely distributed services. I demonstrate this using data on system behaviours in planning and route setting gathered in four African cities, as well as available literature.

Over the past half century, there has been a regular pendulum of approaches to regulation. At present, calls are being made for integrative and supportive approaches, which center or at least maintain the informal transport sector while improving its worst externalities, increasing the professionalism and capacity of firms, and improving working conditions and incomes for crews (J. M. Klopp & Cavoli, 2019; Stucki, 2015). This, however, raises the question of how this mode, if centered and regulated, and accepted as a major – and often only – mode of public transport, will be planned, and by whom?

Workers – drivers, conductors, vehicle owners, mechanics, route managers and others in the transport labour ecosystem – should be recognized as active agents of planning, urban growth and development, and public service providers. This is impossible to disentangle from the structural inequities and exploitation borne by this often marginalized and vilified workforce. Workers and passengers are often pitched against one another in discourse and policy, with the labour rights and job quality of workers coming at the expense of the services available to passenger. Some writers and organizations (Attoh, 2019; ITF, 2018; Spooner & Mwanika, 2018) instead conceptualize an alliance. What form this takes, and what empirical and theoretical work can support policy, activism and organization that support these alliances, requires fleshing out.

From a policy perspective, the reform of informal transport, and integration of formal and informal modes is particularly pressing. Transport plans and reforms often call for informal operators to operate in complement to higher-capacity systems, taking on a feeder role or providing coverage in peripheral areas (Behrens & McCormick, 2012, 2012; Gauthier & Weinstock, 2010; Paget-Seekins & Munoz, 2016). Here, the flexibility of informal transport may be understood as allowing a seamless transition: when a high-capacity mode is introduced, smaller vehicles can adjust and find new niches, even as incumbent operators often resist such reforms (Asimeng & Heinrichs, 2020; Schalekamp, 2017; Spooner et al., 2020). Therefore, how informal modes can or cannot be competitors or complements to high(er)-capacity formal services is important and under-investigated,

Much of the assumptions on flexibility also arrive from the idea that informal transport plays a niche or at least parallel role with formal transport systems. But in many large and medium sized cities, particularly in Africa and Latin America, informal transport is actually the dominant, or often *only* mode of motorized public transport available (Behrens et al., 2015). These are the cities are expected see the fastest population growth in coming decades, while seeing far less planning, investment and research (Pojani &

Stead, 2015). This places the analysis of informal transport networks in a different light and requires dedicated consideration.

The de-facto transport planning work carried out by operators to identify, measure and operate profitably is often de-professionalized and de-skilled, instead becoming a product of instinct, reflex, and responsiveness based on fuzzy 'local knowledge'. In fact, how decisions on operations are arrived at by operators, whether they are correct, whether they are unchanging, and what its consequences are for the distribution of transport and access in the city, require investigation and informed policy. One question is – *can* informal transport networks change their routes? Is this power held by operators? The second is – do they? And the third is the more amorphous question of whether this is good.

METHOD AND CASES

In this paper I focus primarily on African cities, where informal transport or paratransit is the dominant, and often only, motorized mode available. With some exceptions, scholarly work and analysis of informal transport in Africa is dominated by major cities – Nairobi is most prominent, as well as Lagos, Dar es Salaam, Accra, Johannesburg and Cape Town. These cities are exceptional not only for their size, but for their role as political, economic and cultural centers, national capitals and regional and international megacities (Pojani & Stead, 2015). Research on their transport systems is often dominated by questions of overlapping political processes, and complex infrastructure investments. This includes frequent efforts to ban, reform or integrate paratransit, the introduction of BRT or rail services, and questions of national and global visibility and city branding, modernity, development and planning ideology (Mũngai, 2013; Rizzo, 2017)

However, informal transport systems operate – and dominate transport – in almost all cities in Africa, medium and small as well as large. Plans and investments are scarce and the central role of informal transport is uncontested. This paper is based on research conducted in Lubumbashi, DRC, Djibouti-ville, Djibouti, and Lilongwe, Malawi, supplemented by comparative research in Nairobi and drawing on academic and policy literature and a variety of data for a number of African cities.

Research in Lubumbashi was carried out in 2015-16, under the auspices of a public transport reform project funded by the Dutch government¹ and in collaboration with the University of Lubumbashi. It included digital mapping of the city's transport routes and surveys of 250 minibus drivers and 3,000 passengers. Djibouti, in 2019, was likewise a

¹ ORIO grant....carried out with ROM....

transport sector analysis and reform proposal, funded by the World Bank², in collaboration with the University of Djibouti. As well as mapping of the bus routes and an on-street survey of 1,500 passengers, this study also included on-site interviews with minibus drivers, focus groups and interviews with vehicle owners. Further research was also carried out in Lilongwe and Nairobi in 2019 and 2021³, including interviews with drivers, vehicle owners or terminal managers, and the police (in Lilongwe) and National Transport Safety Authority (in Nairobi) officials who are tasked with urban transport regulation.

Nairobi, a metropolitan area of approximately 5 million people, is one of the best studied cases of informal transport, but in many ways highly atypical. In 2010, regulation was passed which organized independent matatus into SACCOs – Savings and Credit Cooperatives. This mandated that each vehicle must be part of a SACCO of at least 30 vehicles and each SACCO limited to operation on a set of pre-defined routes. It is vehicle owners, not drivers, who join the SACCO, and drivers largely continue to be employed by an individual on a one-to-one basis on informal, daily contracts with a daily earnings target (Kelley et al., 2018; McCormick et al., 2013).

Lubumbashi (pop. approx. 1.5-2 million), Lilongwe (1.1 million) and Djibouti (650,000) hew more closely to the model of atomized, independently operating vehicles, with drivers leasing vehicles and competing to fill them across the city, with little further regulation. There are no route-based associations or cartels, and vehicles are licensed to operate city-wide. Authorities and terminal managers maintain a degree of oversight over major departure terminals, including orderly departure queues. However, the choice of which route to operate on, whether to go off-route, or to act as a ‘pirate’, poaching passengers along the route without queuing, is largely at the driver’s discretion (interviews.)

DEFINING INFORMAL TRANSPORT

The definition of ‘informal transport’ and the choice of vocabulary has been widely debated and contested elsewhere (Behrens et al., 2015). Following Behrens et al.’s definition, I focus on modes which do not provide door-to-door, passenger-controlled service, but travel almost exclusively with multiple passengers or groups of passengers at a time, with the decision of where to go set by the driver. This may be in following a given route, deciding to deviate from it, or even improvising destinations in the moment,

² Global Transport Practice - Urban Transport Technical Assistance....

³ Research in Nairobi and Lilongwe was facilitated by a VREF student exchange with the University of Nairobi’s Institute for Development Studies, and a UC Berkeley, Rocca center for African studies pre-dissertation travel grant.

but understood to never fully be under the control of passengers, though the driver may choose to be influenced by passengers' demands. This leaves out the majority of bicycle, motorcycle and most rickshaw operations, while leaving in some four-door sedans and most jeep, van, minibus and, in some cities, midi- and even large-bus services.

A second important characteristic for this definition is the role of the public sector of operation and regulation – services are provided by unsubsidized private sector operators, and there is limited or no 'top down' planning. That is – locations of routes, schedules and prices are not, or very weakly, determined by the state (though they may be enforced, to some degree, by the state once they have been arrived at, or maintained in a given status-quo.)

The third is that the finances of the operation – even where multiple vehicles are owned by a single person or amalgamated into associations or cooperatives - are primarily carried at the individual vehicle level and costs and revenues are not pooled across multiple vehicles.

WHAT IS FLEXIBILITY?

Descriptions of the flexibility of informal transport abound. The term is used almost axiomatically, and generally positively, in reflecting 'passenger needs'. Cervero, 2000, gives a concrete example of reactivity in transportation planning and accessibility terms:

“Private minibus and micro-vehicle operators are more likely to craft new, tailor-made services in response to increases in suburb-to-suburb commutes, trip-chaining, and off-peak travel than are public authorities. Their inherent flexibility and sensitivities to changing markets stand in sharp contrast to the rigidities and unresponsiveness of protected monopolies” (Cervero, 2000).

Likewise, Lagos *danfos* are described as “incessantly flexible, improvisational...adaptive operations in tune with passenger demands, high frequency of service, ability to navigate small streets and provide coverage to populations that otherwise would lack transit” (Alcorn & Karner, 2020). In Kinshasa and Nairobi “the informal transport sector appears highly dynamic, constantly changing its route networks, showing fast and high throughput” (Heinze, 2018). In Cape Town, “rapid evolution and growth of the minibus-taxi industry has clearly demonstrated its ability to respond to user needs and rapidly adapt to changing patterns of demand” (Clark & Crous, 2002) and “these 'paratransit' services quickly respond to user needs and can easily adapt to dynamic patterns of demand” (Ferro et al., 2013). The paratransit industry of minibus and boda-boda services in Kampala is “highly flexible and responsive” (Spooner et al., 2020), and that of Ibadan, Nigeria, “...characterised by flexibility and responsiveness to user demands” (Moyo & Olowosegun, 2021). In Lima, in 1987, minibuses have “flexibility to adjust for peak and slack demand and to change routes as passenger demand changes” (Uzzell, 1987). In

Tbilisi and Bishkek, lack of regulation has “allowed the marshrutka sector to flexibly address diversifying mobility needs” (Rekhviashvili & Sgibnev, 2019).

A vein of research stresses the position of informal transport in local, indigenous and post-colonial context, rejecting a purely market-based understanding, but likewise using language of reactivity and adaptability. Informal transport is “particularly tailored to local conditions and context” and “respond to local transportation needs, tends to have wider coverage, and allows better physical access to destinations” (Mateo-Babiano, 2016, on Indonesia). Brooklyn’s primarily Caribbean immigrant-serving Dollar Vans are “subaltern mobilities, or practices of movement defined as flexible, vernacular, and specific to postcolonial subjects” (Best, 2016). Rekhviashvili and Sgibnev, studying the marshrutka systems in Bishkek and Tbilisi (Rekhviashvili & Sgibnev, 2019) argue against the equation of informal transport and with market-provided transport. Operations should be understood as shaped at least as much by “non-market norms and institutions, involving reciprocity, mutuality and sharing”. In Quito, informal transit “activates practice of care” as services are oriented to improve accessibility and safety in marginalized neighbourhoods (Gamble & Dávalos, 2019).

This assumes that routes can and do change over time without intervention of the state or a central planner, and secondly, that these evolving networks arrive at, or are maintained, in a state that is a “good fit” for passengers and the city. However, these have limited theoretical and empirical evidence to support them. This critique is not new. Writing in the early 1980s, Ocampo identifies strands of tension between sympathetic observers praising, particularly, the ‘responsiveness’ and ‘flexibility’ of these modes, compared to local skepticism over the tendency to utilize the same flexibility to raise prices at will and contribute to congestion (Ocampo, 1982). Rimmer, in 1980, also critiques the preoccupation of writers on informal transport in developing countries for their excessive fascination with cataloguing and classifying vehicle types with ‘exotic names’, to the detriment of studying labor, business or operations (Rimmer, 1980).

Most obviously, against the assumption of responsiveness of operations, and despite the social role of informal transport, there is an obvious limitation: an unsubsidized service can only operate where it is profitable to do so (Cervero, 2000; Grava, 1978; K. M. Gwilliam, 2001). A few specific examples can be referenced: attempts to assign *daladala* to specific routes in Dar es Salaam by the city government failed, because they were deemed unprofitable by operators (Rizzo, 2017.) Otunola et al, on Lagos, similarly observes that less profitable routes are under serviced, “leaving many citizens behind” (Otunola et al., 2019). Writing about urban West Africa, Godard notes that regulation is necessary to counter the private sector focus on “market segments where it is most relevant” (Godard, 2013) and Pirie states that the informal operators of Kampala and Nairobi tend to

“operate a basic route structure” and have shown “little innovation in developing new routes,” (Pirie, 2013).

Assumptions of flexibility in fact often elide different aspects of operations. Daily flexibility, deviations from established routes and fare hikes, is not clearly separated from the medium- and long-term evolution of the route network itself, and there is often little analysis as to how this is constituted by ‘reactivity to demand’ in different systems and in different cities.

DAILY FLEXIBILITY

In terms of daily flexibility, there is little disagreement that informal transport vehicles often deviate from the routes on which they are assumed to be operating. The definition of a route itself may be vague, with multiple possible parallel routes or different end points. Generally, however, minibuses and jitney-type vehicles have relatively set origin and destination points, whether formally sanctioned or collectively recognized. Increasingly widespread and extensive mapping of informal transport systems, indeed, is only possible because some route stability is evident (Digital Transport 4 Africa, 2019; J. Klopp et al., 2015).

Within these generally-agreed-upon routes, drivers have substantial freedom to make changes. This may be to avoid bad traffic, search out new passengers, or due to the requests of existing passengers. For example, minibus drivers in Queens in New York City, and in Tbilisi, Georgia, frequently deviate from their route to drop off passengers in need at their door, such as those with children or heavy shopping (Musili & Salon, 2019; Rekhviashvili & Sgibnev, 2019). In Kampala, there are extensive search behaviours, with drivers zigzagging, stopping to wait along the route, and going off-route in search of potential new passengers when the taxi is underfilled (Ndibatya & Booysen, 2020a, 2020b). In some cities both minibuses (12-20 passengers) and sedan cars (4-6) passengers operate, with minibuses usually having stronger route adherence and sedans having more capacity to deviate according to passenger requests, such as in Iran, in Kano, Nigeria or in Cape Town (Askari et al., 2020; Madugu, 2018; Rink, 2020).

While providing potential benefits to new passengers, this clearly comes at the detriment of existing ones. Interviews with Djibouti drivers found that they will sometimes shift their route based directly on passenger requests, though primarily if these were a sizeable group of the passengers, and were able to vocally make the demand. Interviews with drivers and passengers found considerable frustration with this arrangement – some groups of passengers were able to be vocal – indeed, rude – and bludgeon the driver into route changes. Others were not. Specific to Djibouti, drivers were also frustrated with a norm of very frequent stops, at intervals of just tens of meters, demanded by both

boarding and alighting passengers. This substantially slows the trip, cutting into drivers' earnings and lengthening other passengers' travel times - but drivers perceived themselves as powerless against the demands of middle-class passengers expecting to be dropped at a precise spot along the street, and called for the imposition of regular stop locations by regulators (interviews).

Another common, though rarely measured, practice is the in-completion of routes. Passengers are dropped short of the destination and must walk or wait for another bus to come by. In Nairobi, drivers may coordinate with another matatu to transfer passengers over at no cost. In Lubumbashi, however, there is no recourse, logistical or financial – the vehicle simply turns around (interviews). How frequently this occurs, in what cities, and under what circumstances, is unmeasured. A rare, though now dated, study from Kingston, Jamaica found that 74% of passengers had experienced an incomplete route (Anderson, 1987 in Cervero & Golub, 2007).

There is also the tendency to change fares over the course of the day. Ticket prices in many cities are variable, unpredictable and usually set high during peak hours. This is widely reported (Dube & Chirisa, 2012; Moyo & Olowosegun, 2021) though specific numbers are hard to come by. One report finds Lagos danfos will raise prices by as much as nine times during peak hours (Otunola et al., 2019). Another fare-related form of autonomy is the tendency of informal operators to avoid giving passage to people who hold – or are supposed to hold - discounts, like students and pensioners. This has been found to be the case in Jamaica (Anderson, 1987 in Cervero & Golub, 2007), Tanzania (Rizzo, 2017) where minibuses would avoid stops with students, and Ukraine, where marshrutkas (minibuses) would skip those where they saw elderly passengers waiting – a 2005 Ukrainian law promised them free passage (Vozyanov, 2018).

ROUTING AND NETWORK PLANNING

An arguably more important question is that of the medium and long term evolution of the network. In many cities, bus drivers and owners have the authority to set their own routes. In Lilongwe, operating licenses for public transport vehicles are issued at a city-wide level, and there are no legal restrictions on which locations buses may stop or wait at, as is the case in Djibouti and Lubumbashi (interviews.) On the other hand, in Nairobi, new entrants are required to join route-specific cooperatives, and in Lagos *danfo* vehicle owners must obtain a license for a specific route (Alcorn & Karner, 2020). In Nairobi deviations are illegal and may be enforced by the SACCO or traffic police (interviews) though the practice remains common (Kelley et al., 2018).

Despite lack of government licensing, the transport sector is often highly self-regulating, with organizations or norms at the terminal or route-level which manage orderly queuing

and limit all-out competition between vehicles ((McCormick et al., 2013; Rizzo, 2017; Spooner et al., 2020). However, drivers may also choose to pick up passengers by cruising around, at lower ticket prices, either during off-peak hours or if they've received a poor spot in the day's queue, and this is the case in Djibouti, Lubumbashi and Lilongwe.

How much do operators take advantage of such freedoms? Firstly, informal services are often praised for their ability to go where formal, or at least large, buses cannot, particularly narrow and unpaved roads (Kumar & Barrett, 2008). There is no evidence that operators see the issue the same way. Mapping in Djibouti and Lubumbashi, as well as studies from rural South Africa (Venter et al., 2014) and Nairobi (Kelley et al., 2018), found much higher service levels on paved roads. Operators strongly prefer to avoid unpaved ones to avoid wear and tear on vehicles (interviews).

A small number of other studies examine the operation and distribution of informal operators. A study of a single Dollar Van in New York City, reveals thorough analysis of changing demographics carried out in introducing a new route, as the Caribbean immigrant population that is the basis of ridership is pushed further out (Goldwyn, 2018). Gamble and Puga's study of the socially-driven and carefully considered routes developed by informal transport firms in Quito, Ecuador, with a complex, evolving process of route apportioning between firms. Firms in this instance are highly organized, often with fixed schedules (Gamble & Puga, 2019).

Rural informal operators in South Africa (Venter et al., 2014), are organized into associations, which make routing decisions based on determination of exclusive, violently-enforced geographic service areas. This, coupled with a lack of information by operators as to passenger demand and low densities, means that routes are not "determined with user convenience in mind, leading to sometimes fragmented routes, unnecessary transfers, circuitous routings, and even complete withdrawal of service from conflicted areas." Informal services function as complements to formal, cheaper, subsidized and scheduled buses on the same routes, rather than filling spatial gaps where the latter do not operate (Venter et al., 2014).

The description of rural South Africa in the 2010's matches another unusually detailed study, this one from Lima, Peru, in the 1980s (Uzzell, 1987). Lima's system was organized into associations, each controlling defined zones, which would constantly grow and change in competition with other associations:

"The decision to invade a route is taken very carefully. The new territory is scouted for potential passengers. Existing passengers give information about their preferred destinations.... The ability of the target comite to defend its territory is assessed. A few buses of the invading comite drive the route for a day or two to get a feel for the responses all around. If the number of passengers is inadequate or if the police enforce the law too vigorously, the invasion will be called off. If, after

all this, the project still shows promise, the members approve the plan in general assembly and vote on the amount of money to be set aside for bribes.”

Changes and expansions to route networks in Lima appear to have been driven substantially by competition between comites/associations for the same passengers, rather than by providing new services to new passengers. The ability of competing operators to change their service networks, moreover, was buttressed as much by political party backing and police cooperation as by passenger demand – which itself was garnered by campaigns and petitions, which could be used to show a form of squatters right in Peruvian law, justifying the new routes (Uzzell, 1987).

In summary, the assertion that informal operators can behave flexibly in choosing routes is complex. In some cities, this is clearly the case. In others government and internal regulation hold significant, though never absolute sway. Other factors, particularly road quality, also appear to play an important role in route alignment, limiting responsiveness to demand.

MARKET FORCES AND MARKET FAILURES

Theoretical and empirical work on the *spatial* distribution of services and the processes of arriving at them is surprisingly limited. Most extensive is the study of de-regulation of formal transport in the UK, Chile and Japan (Evans, 1990; Klein et al., 1997; Muñoz et al., 2008). More recently a handful of studies focusing on more fully informal systems in the global south have emerged, in particular a growing body of work on South Africa (du Preez et al., 2019; Neumann, n.d.; Vanderschuren et al., 2021).

A recent theoretical contribution by Ndibatya and Booysen (Ndibatya & Booysen, 2020a), takes the “organic” moniker to perhaps a natural extreme. They characterize Kampala’s minibus taxi travel patterns as a Lévy walk, which “combines an organisms’ need for resources (e.g., food, shelter, or customers) and the need to reduce risks (e.g., from predators or competitors) with the density and renewability of resources to explain the organisms’ movement in space”. While they find only partial evidence to support this argument (of nine taxis in the study, five are found to follow a Lévy walk pattern), they are able to show that the routes evolve substantially over eight months of tracking, and argue that this is due to growing passenger demand, with local residents pro-actively calling minibus drivers to locations they have organized as impromptu terminals (for which they receive a fee from the driver). However, they simultaneously demonstrate that, while determined, the searching behaviour is also desperate and inefficient. The randomness of the process lead to long wait times, stops and deviations, leaving both passengers and drivers exploited. Combined with an analysis of driver’s changing profit

margins, they also show that such searches offer little in the way of greater profits or productivity for the vehicle crew (Ndibatya & Booysen, 2020b).

A number of models of informal transport operations have also been developed. Many of these identify market failures, where de-regulation leads to negative effects on the quality, quantity or location of services (Ardila, 2008; Chavis & Daganzo, 2013; Evans, 1990). Gomez Lobo, for example, states that “competition does not work in urban bus markets.” He argues that private market, free entry services compete on frequency rather than price or quality of service, and raises their prices to a de-facto monopolistic level with or without the emergence of a cartel structure. When it comes to prices, informal transport has little ability to operate flexibly. Individual drivers and operators are locked into stable pricing equilibriums. In this analysis, regulation of frequency and regulation of price, by cartels or route associations, go hand in hand, as the mechanism a bus can use to set a lower fare is only if it arrives simultaneously with others. (Gomez-Lobo, 2007).

One strand of this literature identifies spatial behaviours of evolving competitive transport systems over time. Informal operators use the anchor of a high-capacity formal route to compete at greater frequencies, lower prices, or a more direct or transfer-less route. This damages the passenger base of the core route and it goes out of business, but the informal sector is not able to provide enough service to meet the full demand, the passenger base dwindles, and the service area is then lost altogether. This is based primarily on the UK deregulation experience (Klein et al., 1997), and while Gwilliam extends this to the developing country context, it is only by retaining assumptions on hybrid systems of formal and informal operators (K. M. Gwilliam, 2001).

EXPLAINING OPERATIONS

An analysis of informal transport operations must begin with the weak-to-nonexistent restrictions on market entry, and the informal and exploitative nature of driver-owner labor arrangements. Drivers operate on a daily lease, carry all the risk, and their income is predicated entirely on daily ticket sales. Both these aspects of operations were described in what may be the earliest analysis of urban mass transport regulation. The effects of “competition for the field” and “competition within the field” were laid out by British reformer and public health advocate Edwin Chadwick in 1859, comparing the atomized, free-entry, system of omnibuses in London, to that of Paris, which had introduced route franchising:

“The immediate gain to the public was increased convenience, regularity, and freedom of communication, and a general system of correspondence and increased responsibility. Instead of, as in London, streets encumbered and disturbed by nearly empty, or only partially filled inferior vehicles, sometimes crawling with a few passengers, annoyed by detentions for a full load, at other

times racing, and dangerously overlaid, the circulation throughout Paris was made regular from regularly appointed stations, at fixed charges, which precluded extortionate variations.

But I was particularly struck with the necessary effect of the change in the social relations of the men engaged in the reformed service, in the immediate suppression of that antagonistic relation, and its consequences, which we see most fully developed in London, in perpetual wolfish conflict, engendering habits of ruffianism, with extortionate yet precarious earnings spent in dissipation and without reserves for sickness and old age." (Chadwick, 1859).

The negative externalities, including speeding, congestion, overloading, poor safety, vehicle maintenance, and aggressive behavior are well attested (Agbibo, 2016; Barrett, 2003; Cervero & Golub, 2007; Chadwick, 1859; Estache & Gómez-Lobo, 2005; Ference, 2016; Gomez-Ibanez & Meyer, 2011; Gomez-Lobo, 2007; Kelley et al., 2018; Kumar & Barrett, 2008; Mũngai, 2013; Rekhviashvili & Sgibnev, 2018; Rizzo, 2017.) These are substantial and unequally distributed burdens for passengers and are deeply exploitative of the transport labor force, and have been covered extensively in the literature. In this paper I will focus primarily on the effects of this form of organization on spatial planning and geographic accessibility.

Most important to note with regard to the discussion of informal transport, is that it is in fact not the dominant mode of mobility in urban Africa – walking is. Areas reliant on informal transport are often poorly served, particularly for the lowest incomes and most vulnerable populations, including women, children, the elderly, or those with disabilities (INTALinC, 2019; Munthali et al., 2019; Salon & Aligula, 2012; Salon & Gulyani, 2019).

A number of studies have attempted to measure the accessibility provided by informal transport networks by mapping transport routes and calculating travel times to jobs, schools or other amenities. A recent study of Nairobi looking at access to workplaces found that a large gap existed between wealthy and poor areas, even more so between formal and informal areas, showing that informal transport actually has relatively limited penetration into informal, low-income areas (Nakamura & Avner, 2021). Also in Nairobi, an analysis of access to hospitals finds substantial gaps in the distribution of the matatu system (Campbell et al., 2019). A comparison of access to employment locations in 11 major Sub-Saharan African cities found a great deal of variation, and both low overall accessibility and substantial inequality within many cities (Quiros et al., 2019). In Santiago, Chile, the liberalization of bus transport in 1979 saw expansion of geographic coverage and reduced distance to bus routes. At the same time, bus fares increased by 100%, and despite expansion, 80% of bus routes passed through just six corridors. (Estache & Gómez-Lobo, 2005)

As well as spatial distribution, travel times, convenience and connections also appear to be poor: a small survey of commuters in Lagos, Nigeria, found that over 65% had at least three transfers, including multiple payments (Ibitayo, 2012). A majority of Kingston, Jamaica passengers in 1987 reported that outlying routes services were insufficient and low-frequency (Anderson, 1987 in Cervero & Golub, 2007). Minibus services in Cape Town, which act as feeders for a BRT system (Plano et al., 2018) were found to have long off-peak headways and early end of operations, failing to match the BRT's operations and passenger demands. GPS tracking of Kampala minibuses saw very high waiting and hold-back times (as drivers stop along the trip with a partly-filled vehicle to wait for more passengers) and very low operating speeds. In fact "a large portion of minibus taxi commuters' travel time consists not of actual travel but of sitting in a stationary vehicle waiting," (Ndibatya & Booysen, 2020a).

Finally, studies find high levels of passenger dissatisfaction, discomfort, stress and fear during travel (Asiyanabola, 2004; Ibitayo, 2012; Moyo & Olowosegun, 2021; Nwachukwu, 2014). 40% of Lagos commuters, 40% reported feeling angry or stressed during their commute (Ibitayo, 2012), while in Ibadan over 50% felt the vehicles were unsafe (Moyo & Olowosegun, 2021). In the survey of Lubumbashi passengers (n=2,500), the quality of services was rated as mediocre across all gender and incomes groups.

DRIVER INCENTIVES AND EXPERIENCES

It is well documented that informal transport workers in African cities have precarious, minimal incomes, long working hours, physical difficulty, lack of social and economic mobility, and a grim, fatalistic, devil-may-care attitude embedded in work culture (Agbibo, 2016; Barrett, 2003; Ference, 2016; Mũngai, 2013; Rizzo, 2017; Spooner et al., 2020). But do the 'target' contracts, and resulting precarity, social positioning and economic incentives, lead to the kinds of in-the-market competition, searching out profitable locations to operate, that means a practice of adaptive and responsive route change and creation?

Firstly, it appears drivers often simply do not know their revenues, costs, profits, or have any big picture view of their business. In the surveys conducted in Lubumbashi and Djibouti, drivers yielded highly uncertain assessments of basic facets of operations, such as number of daily trips, volume of passengers, and estimations of daily income. Interviews in Lilongwe found some drivers did not keep track of the number of trips made per day. In a Kampala study (Spooner et al., 2020) many of those involved in the transport business – as vehicle crews or in terminal roles – were found to also do other work, farming, vending or manual labor, to make up the irregularity and shortfall of working on the minibuses.

The 'target' based daily lease system is also often more fluid and complex than it appears at first. In Djibouti, interviews found a frequent state of clashes, hostility and contract-breaking between owners and drivers, drivers cyclically moving from vehicle to vehicle as relationships sour. Vehicle owners, meanwhile, are often dissatisfied with drivers, frequently firing and hiring new ones. In Santiago, some 20% of vehicle crews' income comes from under-reporting ticket sales (Estache & Gómez-Lobo, 2005) and in Nairobi, systemic under-payment of the daily contract fees appears common (Kelley et al., 2018), which is both tolerated and policed by vehicle owners, leaving even the informal contracts dubious and in a constant state of negotiation.

Ference (2021) sheds light on this financial complexity in Nairobi and Mombasa. Relations between different drivers and owners, drivers and conductors and other temporary workers associated with the transport industry are marked by constant conflict, mistrust, surveillance and negotiation. The flows of money, and who is owed what, are both constantly changeable and never fully known. At the same time, there is a strong redistributive element, with constant flows of small amounts of cash into the community through payment for various small and temporary jobs on the vehicle.

As well as freight relationships with vehicle owners and cartels, less often mentioned, is the difficult relationships with *passengers*. In Djibouti, interviews found drivers feeling bullied by middle class passengers into irritating and unprofitable behavior, such as expecting them to stop at extremely short intervals, non-payment, and pressure by groups of passengers to change routes. Disrespect and non-payment from passengers are found to be one of the major problems recounted by minibus crews in Kampala (and, for female conductors, misogyny and harassment) (Spooner et al., 2020).

What kind of impact do these complex and shifting social and monetary relationships and cash flows have on the assumptions about reactive response to demand? A few points can be made: firstly, it is not clear that drivers and crews have an especially good – or any – mechanism for assessing passenger demand via ticket sales. The management of incoming cash from passengers, outgoing cash for expanses (fuel, taxes, bribes) and into the labour-ecosystems (handovers of the vehicle to replacement drivers, payment to terminal personnel), and what is paid, and unpaid, to the vehicle owner is fluid and unrecorded. Calculating or intuiting from such flows whether a given service is better 'serving demand' compared to another, appears unlikely. Relationships with passengers, far from organically delivering a mental demand model of the city, can be confrontational and frustrating for vehicle crews. Secondly, a variety of other considerations play an important role in guiding route choices, including familiarity and a need to meet other social or economic obligations (such as handing over the vehicle to a substitute driver at a particular locations).

MARKET ENTRY AND OWNERSHIP CONSTRAINTS

The other major players whose behaviour and incentives need to be understood are vehicle owners, who may be little involved in daily operations (McCormick et al., 2013), but whose investments regulate the number of vehicles in operation and contribute in to managing competition across routes.

It is notoriously difficult to track precise ownership data, as, in many cities, the group of vehicle owners remains opaque and is often highly politically connected, particularly to the police (Ndibatya & Booysen, 2020b; Rizzo, 2017; Spooner et al., 2020). This has a strong internal logic, as police protect their own minibuses from bribes, extortions, arrests and enforcement of regulations (FERENCE, 2021; Mutongi, 2017). However, not all minibuses are owned by politicians or policemen, and many other middle- and working-class individuals may be the owners of one or more minibuses, usually combining this with full-time work elsewhere.

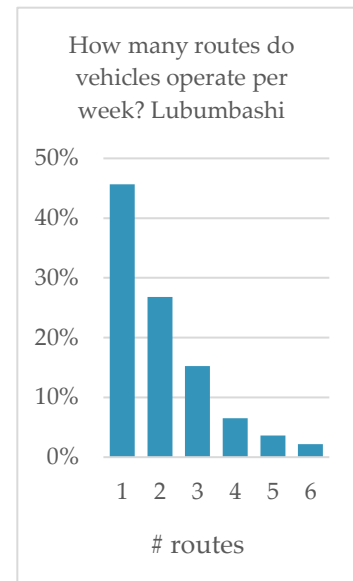
Informal transport networks remain highly atomized in most cities, with little organization into firms. In Lubumbashi, 36% of bus owners had one bus only, and 40% between two and four (driver survey). Small owners may often face precarious incomes from vehicle ownership themselves, as drivers fail to deliver daily targets, second-hand vehicles rack up high costs and lost days in maintenance, and loans rack up interest (interviews, Djibouti, Lilongwe and Nairobi). This means that the even many bus owners may ultimately find that owning a bus leaves them in debt, or with little direct profit to invest in buying more vehicles to expand their business or any professionalization or improvement of services (Spooner et al., 2020).

There does not appear to be any research on how vehicle owners choose which routes to set their vehicles on, or whether there is any discussion, negotiation, advice or expectation of where drivers will go in cities where there are no route-based associations. As with drivers, it is unclear how this form of ownership contributes to flexibility, except in that it is hand-off, and thus offers few constraints. However, the inability, in many cities, to build up businesses and expand ownership to multiple vehicles means vehicle fleets may remain smaller than demand for services and competition between vehicles is limited – this appears to be the case in Lubumbashi, where the total vehicle capacity in 2016 was only a fraction of the city's population and violence was frequently reported in attempts to gain a seat on a bus during morning peak time.

WHO DOES TRANSPORT PLANNING?

In cities where routes are not allocated, who makes decisions as to where buses operate? It is assumed that it is drivers, who are the ones with incentives to draw passengers, in competition with other vehicles, and who are the most on-the-ground agents in the system to assess demand.

In Djibouti, Lilongwe and Lubumbashi, drivers stated that they prefer to stick to familiar routes, and did not report searching out new ones, while acknowledging they theoretically could. In all three cities, licenses are issued city-wide, permitting any vehicle to operate any route, stop, or, indeed, road segment (interviews.) At the same time, stable route networks and key terminals exist, and individual vehicles make decisions as to where to drive primarily along the existing network.



As well as little tendency to ‘explore’, the Lubumbashi survey of drivers found that 46% preferred a single, regular route, and a further 27% drove only on two routes weekly. Driving on multiple routes in Lubumbashi was highly uncommon and only a small percentage of drivers choose this kind of changeable work pattern (survey, n=287).

In Djibouti, meanwhile, much of the city’s traffic is managed through a single central terminal, where new-arriving vehicles choose which queue to join for their next trip. Elegantly, this can be based on the length of the queue, which moves in tandem with passenger demand: if there are more people interested in a given destination, buses on that route will fill more quickly and the queue will be shorter, drawing new-arriving vehicles to that queue and balancing supply and demand.

However, in practice, drivers had much more complex rubrics for their choice of routes, and would often prefer longer waits for specific routes, over serving the obviously in-demand ones. “Good routes” were defined in the tradeoff of route length, traffic and road conditions, as well as familiarity, and not just by the ability to fill the bus. Whether these strategies are indeed the most profit-maximizing ones, particularly given the limitations on assessment of profitability, requires further study, as well as whether they are well-optimized to reflect passenger demand.

In Kenya, however, where SACCOs have a license to operate only on specific routes, it is SACCOs which take the initiative to develop new routes, petitioning the authorities to approve them (interviews). This process is driven by a complex process on the part of the SACCO, which may try out routes with a few vehicles, subsidizing their operations for several months, measure demand - including, in the case of the larger firms, by sending

out surveyors and calculating traffic flows along a corridor - considering market share vis a vis competing SACCOS and firms and advertising new routes by handing out leaflets and hanging posters. Rather than an intuitive process by individual drivers, in Nairobi it is middle management which carries out route planning.

Cervero describes route associations as a critical organizational backbone of informal transport services, arguing these help to prevent duplication of services, balance supply and demand and avoid 'all out anarchy'. Cervero claims that "Route associations exist at all levels of privatized transport services in the developing world"(Cervero, 2000). Gomez-Lobo, is more skeptical, noting that route cartels are not universal and that they vary widely in the types of regulation and enforcement they carry out (Gomez-Lobo, 2007). Rizzo, on Dar es Salaam, notes the spatial nature of worker's organizations, with route-specific associations that can set prices and queues, but only where the route shares few stops with another (Rizzo, 2017).

In Lilongwe, Lubumbashi and Djibouti, while there are cooperatives of drivers, and in Djibouti and Lilongwe, as association of minibus owners, none of these are geographic in nature. The drivers' groups are primarily emergency funds for medical, legal or, grimly, funeral expenses. The Djibouti and Lilongwe owners' associations play a political lobbying role vis a vis the government. Interviews with drivers, owners and regulators in all three cities found no evidence that these groups played any role in developing routes or controlling entry and behavior along them.

Comparing the atomized structure of operations in Lubumbashi, Djibouti and Lilongwe to the strong organizations of Nairobi, as well as evidence in the literature, illustrates collective, organized nature of demand-response. Driver's and other on-the-ground transport workers, caught in exploitative contracts and with precarious incomes, hew to cautious, conservative behaviours to guarantee a return for a given days work. The creative, flexible behaviour which is assumed to be able to pick up varied passengers needs is not evidenced. The effort needed to develop new destinations and routes, and test their profitability, is carried out only at a higher level of organization, such as route associations, who are able to pool the resources needed to carry a loss, on the one hand, and have the wider perspective to direct and manage the expansion of the network, on the other.

SPATIAL ECOSYSTEMS OF LABOUR

Another key issue that emerges in the analyses of the work practices and labor conditions of the transport sector is in identifying not so much as an easily delimited set of professions with specific responsibilities, but as 'ecosystems of labour', with a wide assortment of jobs and sub-jobs (FERENCE, 2016; MÜNGAI, 2013; RINK, 2018; RIZZO, 2017). In

an analysis of Kampala minibus sector, Spooner et al (Spooner et al., 2020), nevertheless take a stab, naming 6 different jobs in a minibus terminal – driver, conductor, caller, loader, guide, and turnboy – and number of other roles such as hawkers and porters, as well as others in the wider spatial ecosystem of work, services and goods provided by the bus terminal. Despite this delineation, they stress that individuals may hold several roles at the same time, or move between them over the course of a work day.

Driver do not only lease buses and hire conductors, they may sub-lease the bus to other drivers for a few hours of the day. This is also an important entry mechanism into the sector. Aspiring drivers may take a role as ‘on-call’ drivers until they develop relationships with owners and get a permanent driving role. Entry into the sector can be time consuming and elaborate, moving up through ranks of terminal worker, conductor, and driver. Turnover is high, and drivers cycle in and out of employment, being relegated to the bench.

In contrast to the free-roving, vehicle-level-autonomy suggested by the most basic competitive model, it appears that the labor force might be highly localized. Once organized routes are established, and particularly once they gain entry barriers, drivers have strong incentives against operating away from them or branching out. The economic and social mechanisms that provide entry into driving and conductor jobs are tied to specific locales and webs of familiarity and kinship, that, for many drivers, further bring them back to the same small set of terminals and routes. It is at these that their labor ecosystem is rooted, rather than stretching across the whole space of the city.

COMPETITION FOR PASSENGERS VS COMPETITION FOR SPACE

Informal transport systems are *inflexible*, nor uncompetitive – they are both. They are also, however, *organized and planned*. A binary conceptualization of competition in-the-market and competition for-the-market is at times used to differentiate formal and informal operators (Cervero & Golub, 2007; K. Gwilliam, 2008; K. M. Gwilliam, 2001; Klein et al., 1997). The latter is assumed to be government-managed, with competing firms bidding for the right to operate a particular route or area, whose exclusivity is then legally enforced. However, in fact a more complex process of free competition for markets exists, as competing firms or associations compete with one another, while limiting and managing their own members competition for passengers along their own routes.

An overlooked distinction is between competition for passengers and competition for *space*. The most atomized approaches, with adaptivity facilitated by individual vehicles competing for passengers, do not fully explain operating patterns. As interviews across Lubumbashi, Djibouti and Lilongwe show, drivers largely simply do not take this initiative. How to explain this, within the context of the limited space for long term

thinking, exploitative working conditions, low incomes and daily leases, and few other employment opportunities?

Hotelling's Law (1929) states that competing businesses, rather than distributing themselves evenly throughout space in order to each capture a unique market share, instead tend to cluster together in order to compete for the densest section of the market. This area receives improved, competitive service, but at the cost of low-density areas that receive no service at all. This is usually applied to static businesses, and has occasionally been considered with the *temporal* clustering of bus services on a single corridor (Cowie, 2009; Foster & Golay, 1986). However, it can equally apply to the clustering of routes and destinations served by vehicles, and appears to be reflected in the experience of deregulated, profit-driven transport networks discussed above.

Another way to think about routing decisions may be in terms of coordination failure, a form of market failure where multiple equilibriums – higher and lower productivity ones – are possible, and a given sector, industry or economy has settled in the lower one. This may be due to disinvestment in knowledge production due to spillovers: if any new approach or know-how adopted developed by a given firm is 'non-excludable' – there here are no barriers for any other firm in the local environment to immediately take it up as well – there is no gain by the firm in putting resources into developing it in the first place, as it will not gain any competitive advantage (Rodriguez-Clare, 2005).

In this sense, searching out new market niches and geographical areas of operation in an atomized transport sector could be considered R&D. This process requires time off operations in established, profitable routes and, given the nature of daily contracts, an associated loss of earnings if a given research attempt is does not immediately prove productive. Booyesen and Ndibataya's study of Kampala (2020b) indeed shows a more sophisticated mechanism in action, with passengers and vehicle operators working to overcome coordination failure by setting up, in advance, pools of waiting passengers.

The process of starting new routes of operations is not a uni-directional one, where passenger demand is 'discovered' like an uninhabited island or new technology. Transport demand for almost all modes is well established as inducible. High frequency services to relevant locations *create* a demand for transport services, particularly at high frequency (English, 2020). However, this process cannot be carried out with a single vehicle, which would not generate the density of service that would communicate to residents that new locations have become accessible and lead to changes in travel habits, and eventually, in residential, employment and other activity location decisions. These are years-long processes that informal operators cannot invest in individually.

To summarize, it appears that individual vehicles compete for passengers along *already established routes*. Cartels, terminal managers, or route associations, or government franchising or firm size requirements, such as Kenya's SACCOs, provide a degree of control of entry and, to a degree, enforce ticket prices and orderly departures, guaranteeing a full vehicle in return for a long wait to all route members. Individual vehicles can choose to circumvent this system to different extents by cruising around, trading off the waiting time with the uncertainty of picking up a full complement of passengers for the same trip length. As some unusually fine grained recent financial analyses from Kampala (Ndibatya & Booyesen, 2020b; Spooner et al., 2020), and the prevalence of both practices in many cities show, neither tactic is particularly advantageous.

Cruising, searching behaviour, does not translate into new routes – passenger bases cannot be consistently established. However, when vehicles are organized beyond the individual level, spatially-responsive, exploratory and competitive behaviour emerges. By pooling together multiple vehicles, pre-advertising routes and stops, and, crucially, creating a 'middle management' cadre who are responsible for the operations multiple vehicles, the market failures that affect the competitiveness of individual drivers are partially circumvented. Firms or association can carry a few days risk, coordinate multiple vehicles, and invest resources into studying and testing new destinations and routes.

Importantly, this does not resolve accessibility issues. In Nairobi, and from available literature, it appears that associations are motivated, firstly, by competition over existing passenger bases, and less in establishing new services. They compete to capture a fraction of traffic on popular routes from competing associations, rather than being primarily interested in extending the network per-se in complementary fashion. Secondly, SACCOs view their services as differentiated on vehicle quality, style (with or without music, for example), and maximum price caps, not on serving specific routes.

CONCLUSION

What kind of agency is held by transport workers? How does this agency materialize, and how does it relate to the public and the city as service providers, and essentially as transportation planners?

It is important to make explicit - informal transport is not equitably flexible and responsive. Operating following not just profitability, but also to reliably serve the complex internal financial flows of exploitative employment, mutual obligation and collective organization within the sector this does not 'fill the gaps' left by formal planning and formal services – it exacerbates them. Informal transport tends to build on

corridors established by formal transport, and doubles down on existing high-service corridors, providing services that primarily serve profitable, simple patterns of mobility.

The dire working conditions, poor knowledge base and limited reliability and margins of the labour structure of informal transport underly this. Where efforts at expansion, niche-finding and creativity are taking place, they are being driven at a level of greater organization, sophistication, managerial capacity and stability than that of the romanticized figure of the ‘ear to the ground’, preternaturally demand-aware driver of a bus or taxi.

Much of the writing on the cruciality and ‘fit’ of informal transport services is difficult to argue with, because there is no alternative. In this regard, the great advantage of informal transport is that it *exists*. There is no dispute that informal transport modes are crucial to mobility – of almost all population groups – in African cities. Nor do I argue that formal transport systems have done any better – they self-evidently have not. Rather, when the pros and cons of informal transport systems are considered, ‘flexibility; and ‘reactivity’ and a special suitedness to local conditions are often regarded positively, alongside low-capital investment, local employment, and – in some place – low prices. This paper aims, foremost, to expand the discussion of flexibility, offer some theoretical and policy points for its analysis and collate the available evidence and discussion in the literature.

Equally, however, flexible behaviour is no guarantee that this flexibility will be used benefit the most marginalized and underserved locations and groups, contribute to mobility justice and equity, or even be aligned so as to best contribute to urban transport measures like poverty reduction, GDP and human development, employment and amenity access or agglomeration economies. While informal actors do act as planners, this planning is limited precisely by its responsiveness. It cannot take on a socially beneficial role. To the contrary. Without intervention and longer-range planning, a marginalized and impoverished workforce, responding to the in-built inequalities of post colonial cities, has little choice but to perpetuate them.

BIBLIOGRAPHY

- Agbibo, D. E. (2016). ‘No Condition IS Permanent’: Informal Transport Workers and Labour Precarity in Africa’s Largest City. *International Journal of Urban and Regional Research*, 40(5), 936–957. Scopus. <https://doi.org/10.1111/1468-2427.12440>
- Alcorn, L. G., & Karner, A. (2020). Integrating formal and informal transit into one hybrid passenger transport system in Lagos, Nigeria. *Transportation*. <https://doi.org/10.1007/s11116-020-10099-8>

- Ardila, A. (2008). Limitation of Competition in and for the Public Transportation Market in Developing Countries: Lessons from Latin American Cities. *Transportation Research Record: Journal of the Transportation Research Board*, 2048, 8–15. <https://doi.org/10.3141/2048-02>
- Asimeng, E. T., & Heinrichs, D. (2020). Why do paratransit operators resist participation in bus rapid transit? Case evidence from Bogota, Mexico City, Johannesburg and Lagos. *Transport Reviews*, 0(0), 1–21. <https://doi.org/10.1080/01441647.2020.1818872>
- Asiyabola, A. (2004). *INTRA-URBAN TRAVEL STRESS IN A DEVELOPING COUNTRY – NIGERIA*. 9.
- Askari, S., Peiravian, F., Tilahun, N., & Yousefi Baseri, M. (2020). Determinants of users' perceived taxi service quality in the context of a developing country. *Transportation Letters*, 1–13.
- Attoh, K. A. (2019). *Rights in Transit: Public Transportation and the Right to the City in California's East Bay*. University of Georgia Press.
- Barrett, J. (2003). *Organizing in the informal economy: A case study of the minibus taxi industry in South Africa*. International Labour Organization.
- Behrens, R., & McCormick, D. (2012). *An Evaluation of Policy Approaches to Upgrading and Integrating Paratransit in African Urban Public Transport Systems: Results of the First Round of a Delphi Survey*. 25.
- Behrens, R., McCormick, D., & Mfinanga, D. (2015). *Paratransit in African Cities: Operations, Regulation and Reform*. Routledge.
- Best, A. (2016). The way they blow the horn: Caribbean dollar cabs and subaltern mobilities. *Annals of the American Association of Geographers*, 106(2), 442–449.
- Campbell, K. B., Rising, J. A., Klopp, J. M., & Mbilo, J. M. (2019). Accessibility across transport modes and residential developments in Nairobi. *Journal of Transport Geography*, 74, 77–90. <https://doi.org/10.1016/j.jtrangeo.2018.08.002>
- Cervero, R. (2000). *Informal transport in the developing world*. UN-HABITAT. https://www.google.com/books?hl=en&lr=&id=_4z7AI6XuH8C&oi=fnd&pg=PA3&dq=africa+informal+transport&ots=V9hMH33Wgn&sig=hvmRBBocpbwmZLjhoLytdyTj4vs
- Cervero, R., & Golub, A. (2007). Informal transport: A global perspective. *Transport Policy*, 14(6), 445–457.
- Chadwick, E. (1859). Results of different principles of legislation and administration in Europe; of competition for the field, as compared with competition within the field, of service. *Journal of the Statistical Society of London*, 22(3), 381–420.
- Chavis, C., & Daganzo, C. F. (2013). Analyzing the structure of informal transit: The evening commute problem. *Research in Transportation Economics*, 39(1), 277–284.
- Clark, P., & Crous, W. (2002). Public transport in metropolitan Cape Town: Past, present and future. *Transport Reviews*, 22(1), 77–101.
- Cowie, J. (2009). *The economics of transport: A theoretical and applied perspective*. Routledge.
- Digital Transport 4 Africa. (2019). *Digital Transport Resource Center (Beta) – An open & collaborative platform to improve urban public transport*. <https://digitaltransport4africa.org/>
- du Preez, D., Zuidgeest, M., & Behrens, R. (2019). A quantitative clustering analysis of paratransit route typology and operating attributes in Cape Town. *Journal of Transport Geography*, 80(C).
- Dube, D., & Chirisa, I. (2012). *The informal city: Assessing its scope, variants and direction in Harare, Zimbabwe*.
- English, J. J. (2020). *The Better Way: Transit Service and Demand in Metropolitan Toronto, 1953-1990*. 368.

- Estache, A., & Gómez-Lobo, A. (2005). Limits to competition in urban bus services in developing countries. *Transport Reviews*, 25(2), 139–158. <https://doi.org/10.1080/0144164042000289654>
- Evans, A. (1990). Competition and the Structure of Local Bus Markets. *JOURNAL OF TRANSPORT ECONOMICS AND POLICY*, 28.
- Ference, M. (2016). “Together We Can”: Redefining Work in Nairobi’s Urban Transportation Sector. *Anthropology of Work Review*, 37(2), 101–112. <https://doi.org/10.1111/awr.12098>
- Ference, M. (2021). ‘You will build me’: Fiscal disobedience, reciprocity and the dangerous negotiations of redistribution on Nairobi’s *matatu*. *Africa*, 91(1), 16–34. <https://doi.org/10.1017/S0001972020000820>
- Ferro, P. S., Behrens, R., & Wilkinson, P. (2013). Hybrid urban transport systems in developing countries: Portents and prospects. *Research in Transportation Economics*, 39(1), 121–132.
- Foster, C., & Golay, J. (1986). Some Curious Old Practices and Their Relevance to Equilibrium in Bus Competition. *JOURNAL OF TRANSPORT ECONOMICS AND POLICY*, 27.
- Gamble, J., & Dávalos, C. (2019). Moving with masculine care in the city: Informal transit in Quito, Ecuador. *City*, 23(2), 189–204.
- Gamble, J., & Puga, E. (2019). *Is Informal Transit Land-Oriented? Investigating the Links Between Informal Transit and LandUse Planning in Quito, Ecuador* (Working Papers) [WP19JG1]. Lincoln Institute of Land Policy. https://www.lincolnst.edu/sites/default/files/pubfiles/gamble_wp19jg1_0.pdf
- Gauthier, A., & Weinstock, A. (2010). Africa Transforming Paratransit into BRT. *Built Environment*, 36(3), 317–327.
- Godard, X. (2013). Comparisons of urban transport sustainability: Lessons from West and North Africa. *Research in Transportation Economics*, 40(1), 96–103.
- Goldwyn, E. (2018). Anatomy of a new dollar van route: Informal transport and planning in New York City. *Journal of Transport Geography*. <https://doi.org/10.1016/j.jtrangeo.2018.08.019>
- Gomez-Ibanez, J., & Meyer, J. R. (2011). *Going Private: The International Experience with Transport Privatization*. Brookings Institution Press.
- Gomez-Lobo, A. (2007). Why Competition Does Not Work in Urban Bus Markets: Some New Wheels for Some Old Ideas. *Journal of Transport Economics and Policy*, 41, 26.
- Grava, S. (1978). Locally generated transportation modes of the developing world. *Transportation Research Board Special Report*, 181.
- Gwilliam, K. (2008). Bus transport: Is there a regulatory cycle? *Transportation Research Part A: Policy and Practice*, 42(9), 1183–1194. <https://doi.org/10.1016/j.tra.2008.05.001>
- Gwilliam, K. M. (2001). Competition in urban passenger transport in the developing world. *Journal of Transport Economics and Policy (JTEP)*, 35(1), 99–118.
- Heinze, R. (2018). “Taxi Pirates”: A comparative history of informal transport in Nairobi and Kinshasa, 1960s–2000s. *Transport, Transgression and Politics in African Cities: The Rhythm of Chaos*, 19–41. <https://doi.org/10.4324/9781351234221>
- Hotelling, H. (1929). Stability in competition. In *The Collected Economics Articles of Harold Hotelling* (pp. 50–63). Springer.
- Ibitayo, O. O. (2012). Towards effective urban transportation system in Lagos, Nigeria: Commuters’ opinions and experiences. *Transport Policy*, 24, 141–147. <https://doi.org/10.1016/j.tranpol.2012.07.009>

- INTALinC. (2019). *Transport Social Exclusion in 5 African Cities*.
- ITF. (2018). *Policy Priorities for Decarbonising Urban Passenger Transport*. https://www.itf-oecd.org/sites/default/files/docs/policy-priorities-decarbonising-urban-passenger-transport_0.pdf
- Kelley, E., Schoenholzer, D., & Lane, G. (2018). *The Impact of Monitoring Technologies on Contracts and Employee Behavior: Experimental Evidence from Kenya's Matatu Industry (Job Market Paper) with Gregory Lane and David Schoenholzer*. <https://www.erinmunrokelly.com/research/>
- Klein, D. B., Moore, A. T., & Reja, B. (1997). Curb rights: Eliciting competition and entrepreneurship in urban transit. *The Independent Review*, 2(1), 29–54.
- Klopp, J. M., & Cavoli, C. (2019). Mapping minibuses in Maputo and Nairobi: Engaging paratransit in transportation planning in African cities. *Transport Reviews*. <https://www.tandfonline.com/doi/abs/10.1080/01441647.2019.1598513>
- Klopp, J., 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 S. Geertman, J. Ferreira, R. Goodspeed, & J. Stillwell (Eds.), *Planning Support Systems and Smart Cities* (pp. 227–241). Springer International Publishing. http://link.springer.com/10.1007/978-3-319-18368-8_12
- Kumar, A., & Barrett, F. (2008). Stuck in traffic: Urban transport in Africa. *AICD Background Paper*, 1. <http://siteresources.worldbank.org/EXTAFRSubSAHTRA/Resources/Stuck-in-Traffic.pdf>
- Lucas, K. (2011). Making the connections between transport disadvantage and the social exclusion of low income populations in the Tshwane Region of South Africa. *Journal of Transport Geography*, 19(6), 1320–1334. <https://doi.org/10.1016/j.jtrangeo.2011.02.007>
- Madugu, Y. U. (2018). Filling the mobility gaps: The shared taxi industry in Kano, Nigeria. *The Journal of Transport History*, 39(1), 41–54. <https://doi.org/10.1177/0022526618759530>
- Mateo-Babiano, I. (2016). Indigeneity of transport in developing cities. *International Planning Studies*, 21(2), 132–147. <https://doi.org/10.1080/13563475.2015.1114453>
- McCormick, D., Mitullah, W., Chitere, P., Orero, R., & Ommeh, M. (2013). Paratransit Business Strategies: A Bird's-Eye View of Matatus in Nairobi. *Journal of Public Transportation*, 16(2), 7.
- Moyo, D., & Olowosegun, A. (2021). Resilience of Informal Public Transport and Urban Land Governance in Ibadan, Nigeria. In R. Home (Ed.), *Land Issues for Urban Governance in Sub-Saharan Africa* (pp. 281–297). Springer International Publishing. https://doi.org/10.1007/978-3-030-52504-0_18
- Müngai, M. wa. (2013). *Nairobi's "matatu" Men: Portrait of a Subculture*. Twaweza Communications.
- Muñoz, J. C., Ortúzar, J. de D., & Gschwender, A. (2008). Transantiago: The fall and rise of a radical public transport intervention. *Travel Demand Management and Road User Pricing: Success, Failure and Feasibility*, 151–172.
- Munthali, A. C., Swartz, L., Mannan, H., MacLachlan, M., Chilimampungu, C., & Makupe, C. (2019). "This one will delay us": Barriers to accessing health care services among persons with disabilities in Malawi. *Disability and Rehabilitation*, 41(6), 683–690. <https://doi.org/10.1080/09638288.2017.1404148>
- Musili, C., & Salon, D. (2019). Do Private Transport Services Complement or Compete against Public Transit? Evidence from the Commuter Vans in Eastern Queens, New York. *Urban Science*, 3(1), 24.
- Mutongi, K. (2017). *Matatu: A History of Popular Transportation in Nairobi*. University of Chicago Press.
- Nakamura, S., & Avner, P. (2021). Spatial distributions of job accessibility, housing rents, and poverty: The case of Nairobi. *Journal of Housing Economics*, 51, 101743. <https://doi.org/10.1016/j.jhe.2020.101743>

- Ndibatya, I., & Booyesen, M. J. (2020a). *Characterizing the movement patterns of minibus taxis in Kampala's paratransit system*. 14.
- Ndibatya, I., & Booyesen, M. J. (2020b). Minibus taxis in Kampala's paratransit system: Operations, economics and efficiency. *Journal of Transport Geography*, 88, 102853. <https://doi.org/10.1016/j.jtrangeo.2020.102853>
- Neumann, A. (n.d.). *A paratransit-inspired evolutionary process for public transit network design*. 267.
- Nwachukwu, A. (2014). Assessment of Passenger Satisfaction with Intra-City Public Bus Transport Services in Abuja, Nigeria. *Journal of Public Transportation*, 17(1), 99–119. <https://doi.org/10.5038/2375-0901.17.1.5>
- Ocampo, R. B. (1982). *Low cost transport in Asia: A comparative report on five cities*. IDRC, Ottawa, ON, CA.
- Otunola, B., Harman, O., & Kriticos, S. (2019). *The BRT and the danfo: A case study of Lagos' transport reforms from 1999–2019*. 28.
- Paget-Seekins, L., & Munoz, J. C. (2016). The promise of BRT. *Restructuring Public Transport through Bus Rapid Transit: An International and Interdisciplinary Perspective*, 1.
- Pirie, G. (2013). Sustainable urban mobility in 'Anglophone' sub-Saharan Africa. *Global Report on Human Settlements. Un-Habitat*.
- Plano, C., Behrens, R., & Zuidgeest, M. (2018). Towards a stated choice methodology to determine minibus-taxi driver willingness to provide off-peak feeder service. *Civil Engineering= Siviele Ingenieurswese*, 2018(v26i8), 19–27.
- Pojani, D., & Stead, D. (2015). Sustainable urban transport in the developing world: Beyond megacities. *Sustainability*, 7(6), 7784–7805.
- Quiros, T. P., Avner, P., & Kerzhner, T. (2019). *Exploring Accessibility to Employment Opportunities in African Cities – A first Benchmark* (World Bank Policy Research Working Paper., p. 40). Work Bank.
- Rekhviashvili, L., & Sgibnev, W. (2018). Placing Transport Workers on the Agenda: The Conflicting Logics of Governing Mobility on Bishkek's Marshrutkas. *Antipode*, 50(5), 1376–1395. <https://doi.org/10.1111/anti.12402>
- Rekhviashvili, L., & Sgibnev, W. (2019). Theorising informality and social embeddedness for the study of informal transport. Lessons from the marshrutka mobility phenomenon. *Journal of Transport Geography*. <https://doi.org/10.1016/j.jtrangeo.2019.01.006>
- Rimmer, P. J. (1980). Paratransit: A Commentary. *Environment and Planning A*, 12(8), 937–944. <https://doi.org/10.1068/a120937>
- Rink, B. (2018). Place ballet in a South African minibus taxi rank. In *Transport, Transgression and Politics in African Cities*. Taylor & Francis. <https://doi.org/10.4324/9781351234221-5>
- Rink, B. (2020). Capturing amaphela: Negotiating township politics through shared mobility. *Geoforum*. <https://doi.org/10.1016/j.geoforum.2020.06.010>
- Rizzo, M. (2017). *Taken For A Ride: Grounding Neoliberalism, Precarious Labour, and Public Transport in an African Metropolis*. Oxford University Press.
- Rodriguez-Clare, A. (2005). Coordination Failure, Clusters, and Microeconomic Interventions. *Economía Journal*, 6(Fall 2005), 1–41.

- Salon, D., & Aligula, E. M. (2012). Urban travel in Nairobi, Kenya: Analysis, insights, and opportunities. *Journal of Transport Geography*, 22, 65–76. <https://doi.org/10.1016/j.jtrangeo.2011.11.019>
- Salon, D., & Gulyani, S. (2019). Commuting in Urban Kenya: Unpacking Travel Demand in Large and Small Kenyan Cities. *Sustainability*, 11(14), 3823. <https://doi.org/10.3390/su11143823>
- 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.
- Spooner, D., & Mwanika, J. M. (2018). Transforming Transport Unions through Mass Organisation of Informal Workers: A Case Study of the ATGWU in Uganda. *Global Labour Journal*, 9(2). <https://doi.org/10.15173/glj.v9i2.3347>
- Spooner, D., Mwanika, J. M., Natamba, S., & Manga, E. O. (2020). *Kampala Bus Rapid Transit: Understanding Kampala's Paratransit Market Structure*. Global Labour Institute.
- Stucki, M. (2015). *Policies for Sustainable Accessibility and Mobility in Urban Areas of Africa*. SSATP. <http://documents.worldbank.org/curated/en/467541468191641974/pdf/95606-REVISED-PUBLIC-SSATPWP106-Urban-Mobility-IO.pdf>
- Uzzell, D. (1987). A Homegrown Mass Transit System in Lima, Peru A Case of Generative Planning. *City and Society*, 1(1), 6–34. <https://doi.org/10.1525/city.1987.1.1.6>
- Vanderschuren, M., Cameron, R., Newlands, A., & Schalekamp, H. (2021). Geographical Modelling of Transit Deserts in Cape Town. *Sustainability*, 13(2), 997. <https://doi.org/10.3390/su13020997>
- Venter, C. J., Molomo, M., & Mashiri, M. (2014). Supply and pricing strategies of informal rural transport providers. *Journal of Transport Geography*, 41, 239–248. <https://doi.org/10.1016/j.jtrangeo.2014.10.001>