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Who counts what? What counts where?

A global scan of data collection efforts in informal and shared mobility

Agile City Partners

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Volvo Research and Educational Foundations

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List of Acronyms

ACP	Agile City Partners
ADB	Asian Development Bank
AFD	Agence Française de Développement
AMT	Agencia Metropolitana de Transporte
ATO	Asian Transport Outlook
BAK	Boda Boda Safety Association of Kenya
BRT	Bus Rapid Transit
CAF	Corporacion Andina de Fomento
CfTS	Centre for Transport Studies, University of Cape Town
COVID-19	Coronavirus disease
CPSU	Fundación Centro Para la Sostenibilidad Urbana
DATUM	Datos Abiertos de Transporte Urbano y Movilidad
DOTr	Department of Transportation
DT4A	Digital Transport for Africa
ETH Zurich	Eidgenössische Technische Hochschule Zürich
EU	European Union
EVs	Electric Vehicles
FCDO	Foreign, Commonwealth & Development Office
FUT	Future Urban Transport
GDPR	General Data Protection Regulation
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GLI	Global Labour Institute
GNPT	Global Network for Popular Transportation
GOTFS	General On-demand Transit Feed Specification
GPIT	Global Partnership for Informal Transportation
GPS	Global Positioning Satellites
GTFS	General Transit Feed Specification
GTFS-RT	General Transit Feed Specification-Realtime
HIC	High-Income Countries
IPT	Intermediate Public Transport
ISM	Informal and Shared Mobility in Low and Middle Countries
ITDP	Institute for Transportation and Development Policy
ITWF	International Transport Workers Federation

JICA	Japan International Cooperation Agency
LAC	Latin America and the Caribbean
LIC	Low-Income Countries
LMIC	Low- and Middle-Income Countries
LTFRB	Land Transportation Franchising and Regulatory Board
MaaS	Mobility-as-a-Service
MIC	Middle Income Countries
MMTIS	MultiModal Travel Information Services
NACTO	National Association of City Transportation Officials
NAMA	Nationally Appropriate Mitigation Action
NAP	National Access Points
NGO	Non-governmental organization
NUMO	New Urban Mobility Alliance
OSM	OpenStreetMap
PPP	Public-Private Partnership
SEA	Southeast Asia
SIM	Shared and Innovative Mobility Services
SLOCAT	Sustainable Low Carbon Transport
SUMC	Shared Mobility Use Center
TNC	Transportation Network Company
TUMI	Transforming Urban Mobility Initiative
UCL	University College London
UITP	Union Internationale des Transports Publics
UMIC	Upper Middle-Income Countries
VREF	Volvo Research and Educational Foundation
WRI	World Resources Institute

I. Introduction

Executive Summary

Shared mobility and informal transportation address mobility and employment needs of people around the world. Operating largely outside of the centralized formal transportation provided by government and standard public-private business models, these systems serve to move people and goods in cities and rural areas. They facilitate the creation of income-generating opportunities and investments, and they have the potential to address other sustainability concerns such as reducing the environmental impact of the transport sector. But how these benefits can be harnessed, to what degree, and under what conditions is not commonly understood.

Globally, the development of shared mobility services grew rapidly in 2016 to 2018 through the emergence of new and expanded services provided by the private sector. In 2016, it is estimated that there was a 10-20% increase in use in urban areas and 45-60% in suburban areas globally (SLOCAT, 2021, p. 167). However, while shared mobility has found a stronger foothold, informal transportation continues to thrive in both urban and rural areas. Informal transportation (also known as "popular transportation" or "paratransit") is highly visible in low- and middle-income countries (LMICs), but much less visible in government policies and investments.

What do we know about how shared mobility and informal transportation systems work? What do we know about the users and the laborers in the sector? We know informal transportation systems are nearly everywhere in LMICs, but do we have reliable data on the extent of their role in transportation globally ? And when we say data, what are we really talking about?

We know that data has a critical role to play in bringing visibility to this important sector. Data can help clarify opportunities and methods for improving the lives of people working in and using shared mobility and informal transportation systems. Data can help improve access, environmental sustainability, economic development, and better governance.

In this review, we take a global look at efforts to collect data on shared mobility and informal transportation. Our aim is to improve understanding of the current status of global efforts to collect statistics and data on mobility, and to provide insights as to how to close gaps in the future. We attempt to find what data exists and is available, why it is collected, and how it is used. We learn from both what we find and from the gaps. This is a scan, and so it is both an incomplete snapshot in time and an ongoing exploration. We know that there are many sources that we have missed, either due to language barriers or network blind spots.

This scan does not cover the active data collection efforts of private companies via location and mobility apps, social media apps, mobile phones and mobile phone service providers, and mobility services. Such services gather location data through GPS readings and Bluetooth beacons (Pegoraro, 2019).

This research is presented in four sections. Chapter 2 explains the research methodology, provides definitions of informal transportation and shared mobility, and describes the geographical scope of the research. The scope and limitations of the study are also found here. The main findings of the research are discussed in chapter 3, which is divided into subsections for each of the main research questions. Chapter 4 provides a summary of the main findings and an analysis of the gaps in data collection efforts, definitions, and in the data itself. It also delves into issues such as lack of transparency, ethical guidelines, a general understanding of what constitutes relevant data, and coverage of mobility data in the context of cultural diversity. Lastly, Chapter 5 identifies ways in which better data and data-collection methods could strengthen sustainable-transport initiatives, as well as areas for further research.

Main Findings

- We classify most of the data collected on informal transport and shared mobility as either statistical data (numerical counts, for example: number of vehicles, ridership, size of labor force, etc., or surveys and census) or mobility data (information generated by movements, e.g., telemetry or GPS traces, or activities, events, or transactions using digitally-enabled mobility devices or services).
- There is robust collection of both statistical and mobility data on shared mobility, and such data is widely accessible. Data collected on informal transportation is limited, and is largely comprised of statistical data on the extent of informal systems on the ground and their operations and characteristics. The data that is available largely depends on the degree of legality of informal transportation.
- There is a difference in how informal transport and shared-mobility data are collected in high-income countries (HICs) and low- and middle-income countries (LMICs). In HICs, the collection of mobility data is integral to the operations of mobility service companies (e.g., ride hail or bike share). Mobility data from these services can give a comprehensive view of the whole of the service. Meanwhile, data collection is mostly a standalone effort in LMICs, often conducted by technology companies or consulting firms with transport-related initiatives. In these countries, mobility data often offers partial, incomplete, representations of the whole system.
- Most of the data that we identified about informal transportation was collected by multilateral and bilateral development agencies, academic and research institutions, and non-governmental organizations (NGOs). Data was also collected by laborers (gig workers), operators, and private companies. Philanthropic foundations funded some of the data-collection efforts.
- We found only a few examples of government agencies leading the implementation of mobility data collection efforts. Often, governments engage private sector and non-governmental organizations to gather data on these systems for research purposes. This lack of government-led mobility data collection efforts is remarkable given the potential of data to inform decisions regarding policy and regulations.

- We found five major categories of purposes for collecting data:
  1) for research;
  2) for business;
  3) to inform public investments;
  4) to inform regulation; and
  5) to inform responses to COVID-19.

- Most data-collection activities in high- and upper-middle-income countries (UMICs) are carried out by private mobility providers. This creates regulatory conflicts with respect to data access, where governments deem the data to be necessary for informing planning or regulation.

- The private sector and non-profit organizations (including open data advocates) lead data collection on informal transportation.

- Most data collection occurs in the largest cities of a given region or country. We found few data collection efforts in secondary or tertiary cities or in rural areas.

- COVID-19 has catalyzed informal transport data collection in LMICs and UMICs. The pandemic advanced innovation in the informal transport sector, including the forging of partnerships between technology companies, transport operators, and governments to enable a transition to contactless payments and devising creative means to comply with safety regulations.

VREF ISM Program

The Volvo Research and Educational Foundations (VREF) funded this study as part of its Informal and Shared Mobility in Low and Middle Countries (ISM) program.

VREF is the collective name under which four foundations finance research and education in the areas of transportation, environment, and energy. Since the turn of the Century, VREF research funding has focused on Future Urban Transport (FUT) with the subtitle, "How to deal with complexity." The overarching goal is to increase accessibility to mobility services for all groups, while at the same time radically reducing the negative local and global environmental impacts of transportation.

The primary goal of the ISM program is to contribute to strengthening equity and sustainability in urban transport, by supporting research that creates new knowledge and informs stakeholders involved in the governance, design and/or development of informal and shared mobility services, thereby contributing to better access to infrastructure and services for all (VREF, n.d.).

Previous research financed by VREF indicates that there are substantial knowledge gaps in numerous areas related to informal and shared mobility. This study takes those research findings

as a point of departure. The growing number of publications and activities addressing informal and shared mobility indicates that there is increased interest in performing research in this area. However, the preparatory work for this study indicates that there is no established international research network or any dedicated global event that could provide a focused exchange of knowledge and ideas in this area. The ISM program will primarily support research performed in low- and middle-income countries (LMICs) on the subject of informal and shared mobility. However, VREF will also seek to strengthen broader international collaboration, by supporting universities and programs addressing these subjects in high-income countries (HICs).

In February 2022, VREF contracted Agile City Partners (ACP) to conduct a global scan of data collection efforts addressing informal transportation and shared mobility. This assignment was intended to improve VREF's understanding of the space. The resulting report was intended for internal use. Subsequently, VREF further commissioned ACP to update the scan with this study, and produce a report suitable for public consumption.

II. Research Approach

This chapter describes the methods used in this study. It starts by providing the definition of informal transportation and shared mobility that was used, including a global overview of both areas. The geographical scope of the research is also defined, using the development-based classification of the World Bank to group countries. Finally, the limitations and the rest of the scope of the study are explained, the main research questions are enumerated, and references are made to work leading up to this study.

A. Definitions and Scope

This research uses the following framing of **informal transportation** from the report From Mobility to Access for All: Urban Transportation Choices in the Global South:

"Without trying to impose a strict definition we refer to all operations with some measure of informality as informal transit." (Washington, DC: World Resources Institute, 2019)[1]

In this study, we define **informal transportation** as encompassing unscheduled services that may exist without fixed routes and are characterized by varying degrees of organization amongst drivers and operators, as well as by varying levels of government regulation.

1 Christo Venter, Anjali Mahendra and Dario Hidalgo,"From Mobility to Access for All: Expanding Urban Transportation Choices in the Global South," Working Paper (Washington, DC: World Resources Institute, 2019)

For **shared mobility**, we apply the framing used by the Shared-Use Mobility Center (SUMC), which broadly defines shared mobility as "transportation services and resources that are shared among users, either concurrently or one after another." According to SUMC, these include public transit; micro-mobility (bike sharing and scooter sharing); automobile-based modes (car sharing, rides on demand, and micro-transit); and commute-based modes or ride sharing (car- and vanpooling). [2]

The SUMC Reference Guide further clarifies that these services are "owned and/or operated by the private sector or government, supported by technology, and involving the shared use of different modes of transport (e.g., cars, bikes, scooters) that operate under an established system within a defined geographic scope" (Parzen, 2015).

In many contexts, shared mobility and informal transportation move goods as well as people. However, for the scope of this research, we focus on passenger transportation and do not include data on logistical services provided by both these transportation systems.

This research investigates and presents findings on shared mobility and informal transportation services separately. We recognize, however, that they may share similar characteristics and functions. The Global Network for Popular Transportation, for example, suggests that "popular transportation is, by definition, shared mobility." [3]

Shared mobility and informal transportation services are found globally, but are particularly prevalent in countries across Africa, Asia, and the LAC region. The statistics below show the significant role that both forms of transportation have played in the transport sector.

Shared mobility and informal transportation at a glance

1. People across Asian cities rely heavily on informal transportation services. According to the mobility assessment reports of the UN Economic and Social Commission for Asia and the Pacific (Regmi and Pojani, 2022), paratransit services[4] are estimated to provide the following shares of transportation modes: 58% in Dhaka, 50% in Jakarta, 40% in Kuala Lumpur, 38% in Metro Manila, and 32% in Surat, India.
2. SLOCAT reported in 2021 that bike sharing peaked in 2017 and then gradually declined through 2020, at which time a quarter of originally-launched services were no longer in operation (SLOCAT, 2021, p.167). However, McKinsey reported in January 2023 that private ownership of

2 https://sharedusemobilitycenter.org/what-is-shared-mobility/

3 From: https://www.popularttransport.net/shared-mobility, retrieved February 24, 2023. (Note that the definition may be self-referential as GNPT cites SUMC for the definition of shared mobility.)

4 Paratransit is another term for informal transport particularly referring to services in the Global South. It offers a broader framework for understanding informal transport services in these contexts, encapsulating the local "diversity of modes and services provision reflecting the lower standard of living, the high densities, cheap labor force and the lack of public transport offer" (Musil et al., 2022, p. 19).

micro mobility was expected to double by 2025, with shared models increasing seven times by 2025 (McKinsey Quarterly, 2023).

3. Africa is highly underrepresented in the bike-sharing market, with just six services launched since 2016. (SLOCAT, 2021, p.167)

4. There has been a surge of tech-based improvements in Africa, in analysis, information and operating platforms for formal and informal and shared mobility services. (SLOCAT, 2021, p.167). This has been evident with the emergence of initiatives from companies and groups developing digital and app-based solutions to map informal transport data, such as WhereIsMyTransport and Data Transport, and start-ups such as Billet Express Mali, eWarren Mobility, AddisMap, GoMetro, and KhartouMap (WRI Ross Center, 2022; Data Transport, 2019).

5. Shared mobility has become a prominent transport mode in the Latin America and the Caribbean region, but further expansion is hindered by insufficient regulatory frameworks and a lack of integration with existing transport modes." (SLOCAT, 2021, p. 63)

6. Informal transport has been essential in the Latin America and the Caribbean region, especially during the COVID-19 pandemic, as it provided access to mobility for millions of people. It filled the gaps left by formal transport systems as it quickly adapted and responded to changes in demand. (SLOCAT, 2021, p. 70)

7. By 2022, "only 15 African cities have mapped their public transport systems and minibus taxi networks in a standardized and open format. At least 105 million people living in African cities do not have reliable information on their transit systems." (WRI Ross Center, 2022, no pagination)

8. In Nairobi, 70% of all commuters that rely on public transport use privately-run matatus (minibuses, Bird et al., 2020), while 74% of all public transport trips in Mexico City are completed on the local minibuses or vans, known as colectivos. In addition to the vital role these informal services play in getting people to work, informal transit is itself an important employer. In Kenya, the informal transport sector and associated services are estimated to employ nearly half a million people (Global Labour Institute, 2018; Calnek-Sugin and Heeckt, 2022; INEGI, 2018).

9. As formal transportation services were drastically reduced in cities around the world during the COVID-19 pandemic, it became obvious how dependent large populations are on these systems. Mexico City shut down 20% of its metro and Bus Rapid Transit (BRT) stations (Almazan, 2020). Kenya temporarily banned all public transport between individual counties in four major cities, including Nairobi (Ombuor, 2020). The Philippines also banned public transportation in its National Capital Region for months, giving way to informal bike sharing (ICSC, 2020). Informal services stepped up to fill the gap left by the removal of formal transit services, and kept cities running, serving as a lifeline for low-income residents who cannot work from home, do not have access to cars, and for whom it is unfeasible to walk or cycle (Madarang, 2020).

Defining Geographies

The World Bank classifies countries according to income: low-income (LIC), lower-middle income (LMIC), upper-middle income (UMIC), and high income (HIC), (Hamadeh et al., 2022). We have followed the World Bank's income-based country groupings with one exception. We have grouped together LIC and LMIC countries, because our findings show that the two groups are similar with respect to their data environments.

B. Guiding Research Questions

The research is guided by a series of questions that aim to capture the overarching narrative on data collection. The questions were developed following a preliminary scan, as well as a series of focused internal discussions on identified blind spots. The blind spots (areas with limited data collection) include: the collection and aggregation of data by governments in LMIC; datasets covering geographies larger than metropolitan areas; government-established data-sharing protocols with private providers; and emerging clusters of research or expertise.

The questions that guided the research are:

1. **What types of data are being collected?** The scan begins by exploring of the types of information being collected on informal transportation and shared mobility. This provides insight into areas of interest on the two subjects.

2. **How is shared mobility and informal transport data characterized?** This question explores how data functions differently across geographies and services, and the factors (such as technology) that impact its utility.

3. **Which groups are at the forefront of data collection efforts?** This question aims to identify the actors driving data collection and the influence that they have on the types of data that are collected. Equally important to who is collecting data is who is not collecting or unable to collect data, and how this contributes to creating gaps and exclusions.

4. **What role do governments play in data collection?** Governments are usually in the best position to collect data or to drive data collection, but their level of participation varies significantly across geographies and contexts. This question aims to better understand more about the role of governments, and the challenges they face, in driving data collection.

5. **What motivates data collection?** This question builds on the previous questions, to better understand why data is collected and how it is being used by different actors. The aim is to identify not only current-use cases of data collection efforts but neglected ones as well.

6. **How is data updated, managed, archived, shared, and protected?** It is critical to understand efforts to manage and govern data to keep it updated, archived, shared, and protected, because this largely reflects how it is used, circulated, and regulated.

7. **What's missing?** This question endeavors to identify opportunities to fill gaps and improve the quality of data on both informal transportation and shared mobility.

C. Methodology

Desk Research

Online Internet searches and desk research were conducted over a span of five weeks from September to October 2022 to gather information and answer the aforementioned guiding questions.

Keywords such as "informal transportation", "paratransit", "shared mobility", "ride sharing", "ride hailing", "bike sharing" and "scooter sharing", combined with "data" or "data collection" and the name of a specific country or region were used as the starting point of the research, via websites such as Google, Google Scholar, ResearchGate, and Academia.edu. Further searches were then carried out on subjects and topics that were found on websites and journal articles as a result of the initial search.

Our research endeavored to scan all global geographies, with varying degrees of success depending on the regions. We were able to find a large representation of efforts from English and Spanish-speaking countries in UMICs, LMICs and LICs. This includes, for example, Kenya, Tanzania, South Africa, and Nigeria in Africa; India in South Asia and the Philippines in Southeast Asia; Mexico, Colombia, Chile, Argentina, and other Latin American and Caribbean countries where Spanish is the dominant language; and parts of the Middle East and North Africa.

The search for information on non-English- and Spanish-speaking countries proved more challenging. We were, however, able to find relevant results in China and non-English-speaking countries in Southeast Asia; French- and Portuguese-speaking countries in Africa; Portuguese-speaking areas in Latin America; French-speaking countries in the Caribbean; and Eastern Europe and Central Asia.

Webinar discussion

On December 8, 2022, the World Resources Institute (WRI), under its DigitalTransport4Africa Webinar Series, hosted a webinar during which the findings of this study were presented and discussed. Fifty leading academics and practitioners on this topic participated in the webinar. Their questions, feedback and recommendations have been incorporated in this report.

Notable discussion topics included how emissions data are collected, by whom and how. This affects shared mobility and informal transportation planning. The participants emphasized the importance of including secondary cities in data collection. While they acknowledge that rapid urbanization is driving the economic justification for prioritizing primary cities, there is a need to generate knowledge on secondary cities for forward-looking policy and planning.

Participants also reacted to the findings on the sources of data collection, with one expressing the following,

> It is quite unfortunate that higher learning institutions and governments do not show up as sources of data. Partly, the data from these sources remain gray because they are either not well packaged or are not accessible on public platforms.

In discussing how this could be addressed, the same participant responded,

> Curating data from higher education requires higher education institutions working closely with governments to produce national data. Otherwise, data coming from universities are isolated case studies which are often not very useful for policy interventions, except at the micro level of local units.

The webinar ended with suggestions for future work, including studies on the ethics of mobility data collection and additional support for groups like SLOCAT and Digital Transport for Africa (DT4A) working on the DT4A pledge (DigitalTransport4Africa, n.d.). The participants also recommended dedicating a webinar to greenhouse-gas emissions resulting from shared mobility and informal transportation.

D. Limitations

While the scope of this study includes non-English-speaking countries, the research was limited to literature, documents, and reports for which English translations were available. The availability of English translations in non-English-speaking countries varied. For example, for research in China we found few translated reports, but some included a report summary in English.

We acknowledge that there is accessible data in databases such as Statista (2022). We did not have access to subscription databases and did not have resources within the scope of the study to conduct analyses of these data sources.

III. On Data Collection

This chapter reports the main findings of the research. It is divided into subsections headed by the main research questions. It starts by enumerating the types of data being collected on both informal and shared mobility. It then presents an examination and comparison of shared-mobility and informal-transport data and looks at how data are utilized by HICs, LMICs, and LICs.

Next, the section outlines the main groups that are collecting data on this front and summarizes their respective efforts. Their motivations and the objectives driving these groups are also explored.

Lastly, the research examines how data on informal and shared mobility is managed, archived, and protected by the different groups that collect it, and how these efforts differ among HICs, UMICs and in specific regions.

A. Defining categories: statistical and mobility data

This research found that groups mainly collect two types of data: statistical data and mobility data.

Statistical data refers to data that are numerical counts, such as the number of operators or number of vehicles, categories of vehicles, or percent of the population using services. These counts are usually gathered through surveys or censuses.

Mobility data, refers to "...information generated by activity, events, or transactions using digitally-enabled mobility devices or services"(NACTO and IMLA, 2019, p. 2). Mobility data often has a temporal element, assigning time as well as location to each point.

Mobility data is "frequently recorded as a series of points with latitude and longitude collected at regular intervals by devices such as smartphones, shared micro-mobility vehicles (shared bikes, e-bikes, scooters, etc.), on-board vehicle computers, or app-based navigation systems (e.g., Waze, GoogleMaps, etc.). Depending on the device used to capture the data, other characteristics, such as the speed of travel, or who is making the trip, can be connected to each individual latitude/longitude point"(NACTO and IMLA, 2019, p. 2).

Table 1 below enumerates the various statistical and mobility data types found in this research. More information on specific sources for these data types is detailed in Annex A.

We find more statistical and mobility data on shared mobility than informal transportation in terms of the quantity collected, and/ or researched as well as access to and availability of said data. The data come in exact counts and measurements, as compared to informal transportation where there tend to be ranges and caveats of estimation for both statistical and mobility data.

In informal transportation, for example, statistical data concerning fee structures, and mobility data such as bus stops and service schedules, are not fixed. Fares can be negotiated, service schedules are fluid, and bus stops are not pre- determined and regulated.

In comparison to shared mobility, informal transportation data is limited and usually constitutes more statistical data than mobility data. It focuses on establishing the extent of the informal system on the ground and its operations and characteristics. Since many of these systems have not been studied extensively, initial data collection aims to understand the number of operators, the routes, demand behavior, as well as gaps and level of user satisfaction in these services. In some cases, the data goes beyond mapping to include ridership, General Transit Feed Specification (GTFS)[5], and even establishments that are accessible within a certain period of time from an informal transit stop (thereby contributing to accessibility). The most common purpose of the data collection we found was to understand transport demand and find ways to make routes more efficient (i.e., planning) and to advocate for or against existing or proposed policies (i.e., advocacy) (Klopp and Cavoli, 2019).

The degree of legality (or illegality) of informal transportation constrains efforts to source both statistical and mobility data on informal transportation systems. To be counted, to be recorded, and/or to be a data source, can involve risk, including the risk of the service being disrupted or prohibited.

5 General Transit Feed Specification (GTFS) is a popular and versatile format for public transport data that can capture both static and real-time route specifications (GTFS.org, n.d.).

Table 1. Types of Statistical and Mobility Data

Statistical Data
Database of bike-sharing projects: bike trips per day, fee structure, operator, type of bike used
Economic data on shared mobility as a sector under the shared economy
Foot traffic, population density, car traffic, proximity to cycle lanes and bus stations, and first- and last-mile entry and exit of service use
Geographic data (limited to presence in towns or cities), type of service (docked or dockless), and ridership levels (number of rides) for bike-share and scooter-share systems in the US
Shared mobility profiles of the 50 largest metropolitan areas in the United States (US), including data on availability of bike shares, e-scooters, and car-sharing, as well as links to regulations on dockless bikes
Database of more than 100 micro-mobility policies and regulatory frameworks from over two dozen countries
Transaction data of informal transport services conducted on mobile apps
E-bike ownership details, total number of e-bikes on the road
Vehicle ownership details, operator or franchise details (if applicable) total number of vehicles on the road
Vehicle performance data for emerging technologies (i.e., electric buses) including acceleration time, uphill time, and energy consumption
Sociodemographic information, labor-market participation, and technical questions related to the vehicle
Socio-economic profile of informal transport users, trip purpose, trip evaluation
Demand data and analysis for paratransit minibus services, called "taxi-be," within and around the city, with a sample data comprising about 3,300 paratransit users gathered from a minibus user survey
Travel experience – condition of PT vehicles, crime on PT, driver behavior, PT comfort & reliability, sexual harassment, affordability, traffic fatalities, driver and route ranking on apps
Travel efficiency – vehicle occupancy, CO2 emissions, congestion
Comparative data and visual information on how global cities perform on key mobility, spatial, social, economic and environmental indicators
Mobility Data
All information collected on ride-hailing applications (e.g., origin-destinations, trip costs, trip frequencies)

List and map of agencies (places) that offer data feeds in General Transit Feed Specification (GTFS) or GTFS-Realtime (GTFS-RT) format
Estimates of e-bike taxi prevalence around metro stations in Shenzhen, China, using street view on Baidu Maps
Route data for informal transport services in Metro Manila
General Transit Feed Specification (GTFS) maps of Tap Taps[6]; transportation patterns (O-D) and measurement of traffic congestion levels in specific areas
Mobility and fare data for taxi-motos
Public transport data (Transit Data, Point of Interest Data, and Real-time Alerts), focusing on informally-run public transport in emerging cities globally
Spatiotemporal information, GPS data, origin and destination matrices, health facilities, High Resolution Settlement Layer (HRSL)[7], OpenStreetMap road network, financial services, Google Earth imagery, Performance Measurement System for Formal Mobility and Paratransit in Sub-Saharan Africa
Distance traveled per person, mode share, period of travel, transfers, travel time, accessibility
Service schedules, location and name of stops, track and shape of the route, observed speeds, vehicle filling, etc., across land and lagoon transport networks

B. Exploring functions: regions, technology, and governance

Shared mobility and informal transport data function in distinct ways in HICs and LMICs. In HICs and LMICs, shared mobility data are collected by technology companies that build platforms for ride-sharing services. These services are in turn dependent on technology platforms in order to exist at scale. In contrast, in LMICs where informal transport systems are widespread, technology platforms recruit existing informal transport operators or passengers to gather new data about users and to provide location or ride-hailing services.

In HICs, digital technology (and, consequently, mobility data) is integral to shared mobility operations. Private companies build the technology platform and recruit new gig workers or drivers (and their cars) to their platform. Some shared services, such as car, bike, and scooter sharing, own the vehicles that they manage through digital platforms. While there were shared mobility services before the rise of the platform-driven mobility companies such as StattAuto in Germany (StattAuto, n.d.), shared mobility services cannot exist at scale without digital technology.[8]

6 Colorful, bus-like pick-up trucks used as informal transport vehicles in Haiti (Thompson, 1996).

7 Satellite imagery data that provides estimates of human population distribution (Columbia CIESIN, n.d.)

8 While public transportation services did collect bus and train telemetry data through vehicle location systems (VLS) prior to the emergence of private-sector digital platforms, this data was not publicly available until the

Research using mobility data from shared mobility companies (assuming the data is not intentionally redacted to protect the company and/or user privacy) will provide a complete or nearly complete picture of the service.

In LMICs, digital technology platforms are grafted onto informal transportation systems that are already in operation. There were boda-bodas in East Africa and okadas in West Africa before the rise of ride-hail apps like SafeBoda and Gokada for two-wheelers[9]. There were ojeks in Indonesia and motosais in Thailand before the rise of Gojek and Grab. There were passenger three-wheelers in South Asia and Southeast Asia before the rise of call-centers and then app-based hailing services such as Uber and Ola.[10] Therefore, research using shared mobility data from informal transportation app providers may not provide a full picture of the system. A potentially substantial set of operators and users may not be using the apps and therefore may not be represented in the data.

The relationship between taxis and ride-hailing apps in HICs has developed differently. Uber began as a replacement to dial-a-limousine taxi services. As car-based ride-hail expanded, the services became a workaround, to provide app-enabled taxi services while skirting taxi-regulations. The existing taxi operators at times resisted, contested, or created their own apps with varying success (Goldstein, 2018).

Technology platform mobility data requirements in different contexts face specific governance challenges. Technology initiatives such as Mobility-as-a-Service (i.e., integration of various modes of transport and transport-related services into a single, comprehensive, and on-demand mobility service) and the creation of "digital twins" (i.e., real-time virtual counterparts of transport networks or systems) would benefit from the interoperability or standardization of data. In HICs and UMICs, operators depend on technology platforms from private companies. Any development or implementation of standardization policies will likely require participation from these service providers. .

We have identified some exceptions. For example, public agencies pioneering MaaS in Northern Europe are building or contracting the technology infrastructure themselves, using public transit as the core service.

In LICs and LMICs, using technology to integrate informal transportation services into formal transportation systems requires working with individuals or the organizations that serve informal transportation operators. In this context, integration refers to the inclusion of informal transportation in the services available on technology platforms. Governance would require representation from the operators and their organizations, with the technology platforms serving

development and widespread use of the General Transit Feed.

9 Local forms of motorbike taxis in East and West Africa.

10 Note that this difference does not hold for bike and scooter sharing services or car-based ride-hail services. These services did not widely exist in Asia or Latin America before the app-based services arrived. Taxi services also pre-date ride-hail apps in all regions. Ride-hail apps have variously either engaged recruited taxi operators or competed or both.

as enablers rather than organizers or representatives of the sector. Various examples of this approach can be found in the literature, including the Seoul bus reform program, in which informal bus drivers were included in the conceptualization and implementation of the program. This integration was later deemed crucial to the program's success (Allen, 2013).

C. Mapping groups and efforts

Data on informal transport and shared mobility are collected by a wide variety of groups, each with a specific objective.[11] Most prominent among these are the multilateral and bilateral development agencies, as well as non-governmental organizations, which comprise the largest existing sources of collected data on informal transport and shared mobility worldwide. This is followed by private companies, which are either start-ups or established shared-mobility app providers, and academic institutions supported by grants. Other groups include gig workers, professional associations, and philanthropic foundations.

In some cases these groupings overlap through partnerships, such as collaboration between the French Development Agency, Transitec, and TransportforCairo to map information transport routes in Africa.

The list of groups is provided below.[12] At the end of this section, Table 3 provides an overview of organizations under each group and corresponding summaries of their work.

- **Multilateral and bilateral development agencies**

  These agencies include transport in their respective development agendas, most of which are centered on sustainable mobility initiatives. Efforts include the development of a transport database, financing sustainable mobility projects including the funding of mass transit projects in both LMICs and LICs through loans and/or grants, and supporting the formulation and updating of master plans across LMICs in Asia, Africa, and Latin America.

  Data collection for these initiatives is typically carried out by consultants and not shared, systematized, or updated following the conclusion of the project. Other efforts include a few specific projects concerning mapping of informal transport in developing countries, such as the World Bank partnership with WhereIsMyTransport (WhereIsMyTransport, n.d.).

11 This is not the case for data collection via technology platforms, whether performed by mobility providers of mobile technology companies (e.g., using map apps and mobile phones, which collect terabytes of data through the use of their services).

12 An interactive map of the initiatives discussed in this section can be accessed here: bit.ly/vrefmap

- **Non-governmental organizations**

  Efforts by organizations such as DigitalTransport4Africa, OpenStreetMap communities, and Trufi Association focus on informal transportation data collection and in some cases the creation of open-source databases. These projects mainly receive grant support from foundations, development aid organizations, international financial institutions, or kickstarter campaigns and volunteer efforts.

- **Private companies**

  Private companies include entities such as consulting groups that provide shared-mobility and informal-transport data collection and analysis as a contracted service, as well as shared mobility apps. This does not include the ride-sharing services that generate data.
  The companies identified through this research include start-ups that were established to fill a gap in the transport sector. Examples of this include eWarren Mobility, AddisMap, GoMetro, and KhartouMap in Africa. Some have received funding from institutions such as the World Bank or governments to provide their services in research projects, while others got started through competitions hosted by other organizations, such as the Innovation Challenge spearheaded by DT4A. Some of these companies are also shared-mobility app providers, which have a presence in HICs, UMICs, and LMICs, such as Uber, DiDi, Gojek, and Grab.

- **Research and academic institutions**

  Universities have played a major role in developing data-collection methods for studying informal transport (e.g., Behrens et al. 2015, Williams et al. 2015) and shared mobility, as well as sharing and analyzing the data collected. These institutions contribute to data collection efforts and aim to add to the existing body of literature that guides policy decisions in the sector, including the regulation and possible integration of informal to formal transport modes. Pioneering research (such as that performed by Digital Matatus in Nairobi) has triggered and inspired similar mapping activities in other countries and cities, resulting in activities led by researchers, activists and private companies.

- **Gig workers**

  Gig workers in shared mobility and goods delivery include "independent contractors or freelancers who typically do short-term work for multiple clients" (Wingo, 2021). They include drivers working through ride-hail and delivery apps such as Uber, Lyft, DoorDash, and Instacart. Gig workers supporting these companies have organized to collect their own data to challenge the way tech platforms price and assign work (Marshall, 2021). The information they have gathered can be used to help them decide which "gigs" to eventually accept.

- **Professional associations**

  These associations include service providers in the transport sector as well as professionals involved in labor and union work, such as the Global Labour Institute (GLI) based in Manchester, England and the International Transport Workers Federation (ITWF). The data-collection efforts of these groups include mapping their members (for service providers) and conducting research on informal transport (other professional groups).

- **Philanthropic funding**

  This includes grants provided by philanthropic foundations, within specific sectors of interest. Although funding is available to support research on informal transport and shared mobility, large investments in data-collection efforts in these areas are not common.

1. Multilateral and bilateral development agencies

The Asian Development Bank (ADB) is building the Asian Transport Outlook Database (ATO), an open-data resource that will include national-level data on the transport sector in 51 economies in the Asia and Pacific region. The project is being funded to support the Bank's developing member countries in transport policy development and delivery. ATO includes more than 450 national indicators as well as an urban database consisting of 84 indicators covering 460 cities. The database will also document the institutional frameworks, policies, and financing of transport in these economies. Examples of indicators include "two-wheeler mode share" per country and "IPT modal share" (intermediate public transport). ATO also contains data on non-motorized two-wheelers: pedicabs, bike rickshaws, two- and three-wheeler motorization. ATO will also include a "Shared and Innovative Mobility Services" category (SIM), with indicators and information on bike sharing, apps, shared mobility, ride hailing, registered app subscribers, and two-wheeler shared mobility services (including taxis).[13]

The World Bank (WB) has partnered with private companies like WhereIsMyTransport to map informal transport routes in Africa. Specifically, the WB has commissioned data collection on mobility in: Cape Town, South Africa; Douala, Cameroon; Harare, Zimbabwe; Kampala, Uganda; Lusaka, Zambia; Maputo, Mozambique; and Zanzibar, Tanzania. These are places where the majority of citizens rely on informal modes to access employment opportunities (Where Is My Transport, n.d.). The WB has supported non-government organizations to map public transport services, such as Trufi, which has developed the first complete public transport map of Nouakchott, Mauritania. In April 2022, the WB published a policy-research working paper estimating the demand for informal transport in Antananarivo, Madagascar (Iimi, 2022). The paper is part of a larger effort by the WB to provide public access to its research and contribute to discussions about development policy around the world. The report includes demand data and analysis for

13 As of the writing of this study, no data was available from ATO on the SIM indicators.

paratransit minibus services, called "taxi-be," within and around Antananarivo, with sample data consisting of about 3,300 paratransit users gathered through a minibus user survey (ibid.).

The German Agency for International Cooperation (GIZ) is leading a consortium of 11 partners known as the Transforming Urban Mobility Initiative (TUMI), which has started work on creating the TUMI Mobility Data Hub — a global database on mobility. There is currently limited information on TUMI, but materials shared with this research team state that the project intends to "drive decision making for sustainable mobility with digital data." Contacts within TUMI have indicated that the database will include formal and informal transportation. GIZ's TUMI project partners include: Trufi Association, Eidgenössische Technische Hochschule Zürich (ETH Zurich), WhereIsMyTransport, Corporacion Andina de Fomento (CAF), and New Urban Mobility Alliance (NUMO).

TUMI's Mobility Hub was featured in Internationales Verkehrswesen. Eidgenössische Technische Hochschule (ETH) Zurich students used high-resolution satellite data and artificial intelligence to create a physical representation of Zurich, with the goal of helping decision makers and planners provide better transit options. Different sources (e.g., phone data, GTFS, GPS, LiDaR) were used to form a database for integrated transportation and mobility planning. Under TUMI's Women Mobilize Women initiative, gender-specific data is currently being collected in three African cities (Plikat and Tesfay, 2022, p. 52).

Agence Française de Développement's (AFD) global urban mobility agenda is funded at a level of more than 500 million euros/year, representing 60% of AFD's total average annual commitments. **AFD finances sustainable mobility projects in developing countries through loans and/or grants, and is deeply involved in mainstreaming informal transport into their large public-transportation and infrastructure projects.** AFD has invested in the collection and management of open standardized data and aims to mainstream such data in its project work. An important example of this is the digital commons approach supported through DT4A, which has published reports funded by AFD on emerging mobility technologies, such as privately-owned paratransit mini buses that provide transportation for the majority of African urbanites.

In partnership with GIZ, AFD also supports the formulation of Sustainable Urban Mobility Plans (SUMPs) for cities globally. A major effort under this initiative is the SUMP Toolkit, which pools together various guidebooks and resources for "transitional and developing countries" that are formulating their own SUMPs (Changing Transport, n.d.). In relation to this, AFD finances technical partners under the MobiliseYourCity (MYC) Initiative. An example of which is the Cooperation for Urban Mobility in the Developing World or CODATU, a civil society organization serving as the MYC secretariat in Brussels and the lead for monitoring the program in Africa (CODATU, 2019). Beyond the MYC initiative, AFD also supports CODATU in the implementation of technical assistance projects in Columbia, Brazil, and Egypt.

The Japan International Cooperation Agency supports the development and updating of national, regional, and city-based transport master plans across LMICs in Asia and Africa. The objective of said support is often to identify priority investments for transport infrastructure improvements

and other transport projects. Select projects identified in these masterplans are evaluated for potential Official Development Assistance (ODA) support from the Japan International Cooperation Agency (JICA). In the process, these studies gather baseline transport data (i.e., modal share, vehicle ownership, trip production and attraction rates, etc.) for the cities, regions, and countries that they cover. Examples of cities with published JICA urban transport master plans include: Metro Manila, Philippines; Metro Cebu, Philippines; Myanmar; Jabotabek, Indonesia; Maputo, Mozambique; Kinshasa, Democratic Republic of the Congo; and Dar es Salaam, Tanzania.

In Latin America and the Caribbean, the Inter-American Development Bank (IDB) is supporting the collection of urban mobility data through the Observatory of Human Mobility, which it co-manages with the CAF. With the objective of facilitating infrastructure investments in the region, the initiative aims to build and maintain a transport database of indicators supporting the four pillars of the mobility agenda, namely: universal access, efficiency and quality, safety, and clean mobility (IDB, 2020). Apart from co-managing the data observatory, CAF has also partnered with TUMI to support the publication of studies exploring innovative data-collection methodologies (CAF, 2022).

2. Non-governmental organizations

Our research findings indicate that non-profit and non-governmental organizations lead the collection and aggregation of data in geographies larger than local or metropolitan jurisdictions. These efforts tend to be funded by grants from development-aid organizations or international financial institutions. There are notable exceptions of multicity aggregation led by private companies, such as GoAscendal, TransportforCairo, and WhereIsMyTransport. These efforts usually cover data from the cities where these companies operate.

The Fundación Centro Para la Sostenibilidad Urbana (CPSU), in partnership with the Global Partnership for Informal Transportation (GPIT) and with technical support University College London (UCL)-Bartlett, developed the Enciclopedia del Transporte Informal en América Central. The work was co-led by Agile City Partners. GPIT was renamed the Global Network for Popular Transportation (GNPT) in January 2023. This encyclopedia is a crowdsourced glossary of vehicle types, names, photos, operation details, and user perceptions gathered from Costa Rica, Panamá, Guatemala, Honduras, El Salvador, and Nicaragua. The project to develop the encyclopedia was conceptualized as a proof of concept for a Global Encyclopedia for Informal Transportation. It was funded by the United Kingdom (UK) Embassy in Costa Rica.

GPIT is expanding that pilot glossary through a project funded by UNDP Accelerator Labs. Additional glossary entries are being developed for the participating members, which currently include Bolivia, Guatemala, Indonesia, Kenya, Lebanon, North Macedonia, Togo, and Zimbabwe.

The **International Association of Public Transport** has convened a working group on informal transportation with the aim of developing a framework for reforming the informal transport sector (UITP, 2021). The program will involve technology and mobility data as core components.

Digital Transport for Africa (DT4A) and Datos Abiertos de Transporte Urbano y Movilidad (DATUM) are sister initiatives in what they call "a collaborative digital commons and global community that scales up and supports urban mobility projects through open data and peer-to-peer knowledge sharing." At the core of both projects are Columbia University's Center for Sustainable Urban Development, and MIT's Civic Data Design Lab, two of the organizations that developed the Digital Matatus project. The project originated from civil-society organizations with experience and interest in advancing participatory mapping, data standards, and the mapping of informal transportation. DT4A is led by WRI, with funding from AFD, GIZ, and WRI. DATUM is supported by IADB and the Mastercard Foundation.

Affiliated projects are executed by different local partners who generate their own funding support. DATUM projects generally appear to utilize crowdsourced data-collection methods. Data collection in DT4A tends to be linked to specific transportation projects funded by international organizations. For example, the project to map the informal transportation network in Abidjan, Côte d'Ivoire was principally owned by the Ministry of Transport of Côte d'Ivoire, but it was financed by AFD and implemented by Jungle Bus, Systra, and the OpenStreetMap Côte d'Ivoire (OSM-CI). Annex A attached to this study lists cities for which projects allied with DT4A and DATUM have conducted mapping activities.

The Trufi Association is a non-profit NGO focused on open source, open data, mapping, education, and training for institutions and volunteers. Trufi was founded by a group of German and Bolivian volunteers in 2019. Trufi started with the development of a journey-planning app for commuters in Cochabamba, Bolivia. According to their website, Trufi maintains journey-mapping apps in: Duitama, Colombia; Tétouan, Morocco; Herrenberg, Germany; Accra, Ghana; Addis Ababa, Ethiopia; Hamburg, Germany; and Cochabamba, Bolivia. As previously mentioned, Trufi with support from the World Bank developed the first complete public transport map of Nouakchott, Mauritania. Other partners listed on Trufi's website include GIZ, HOCHBAHN, WRI, the Institute for Transportation and Development Policy (ITDP), ITS World Congress, Logistics Initiative Hamburg, MobilityData, Principles for Digital Development, TUMI, and Union Internationale des Transports Publics (UITP).

Amend, a road safety NGO, is compiling data on motorcycle taxi operations across Africa. The Amend project has started, but there is no public information available as of yet. Amend is headquartered in the US, with offices in France, Ghana, Mozambique, and Tanzania. They claim to run programs in more than a dozen countries in LICs.

3. Private companies

GoAscendal,[14] a South-Africa-based technology company known for its work mapping 528 minibus routes in Cape Town, established the African Urban Mobility Observatory under a grant from the former United Kingdom Department for International Development's High Volume Transport program (HVT, 2022), which is currently under the United Kingdom Foreign, Commonwealth & Development Office (FCDO). According to the GoAscendal website, "Data collection technologies will include a mix of User Movement Analytics integrated mobile apps, USSD/WhatsApp/ Web-based surveys, and limited field surveys." The geographic coverage is cities in Botswana, DR Congo, Ethiopia, Lesotho, Malawi, Nigeria, Rwanda, South Africa, and Tanzania.

GoAscendal has a contract to map informal transport in Guadalajara, Mexico for IMEPLAN (City of Guadalajara agency) and to launch a journey-planner app for the City. The project includes funding from GIZ and NUMO. WRI Mexico is the project management unit.

WhereIsMyTransport started urban observatories, similar to that of GoAscendal, with funding from the World Bank and started with mapping informal transportation against areas prone to flooding in Sierra Leone. WhereIsMyTransport mapped Mexico City's extensive public-transport network, including the colectivos. The effort was launched in response to Mexico City's Secretaría de Movilidad — the local government mobility department — calling for technology platforms, such as Google Maps, to offer alternative routes to help citizens save time and avoid traffic congestion. GoAscendal's and WhereIsMyTransport's maps and data are publicly available on their website and platforms.

Transport for Cairo (TfC), an advisory practice focusing on urban mobility, has spearheaded the mapping of Greater Cairo's public-transport network through its TfC Data Lab, which has been supported by funding partners such as the World Bank (TfC, n.d.).

In the Philippines, **Sakay.ph** has mapped routes of road-based informal transport modes, such as Jeepney and UV Express services, as part of their journey-planner app that is used by approximately half-a-million commuters in Metro Manila. This initiative was founded by By Implication, Inc., as part of the Mobility-as-a-Service (MaaS) solutions they offer to cities and states, employers, transport operators, urban planners and developers, transit authorities, and corporations. Their data-collection efforts support the delivery of services such as transport management systems, payments and ticketing, ride bookings, urban-mobility intelligence, and advertising.

Local tech-startups and citizen communities contribute baseline data. Tech-based groups and start-ups that collect mobility data and map informal transport have emerged in recent years. Some of their initiatives focus particularly on collecting and analyzing informal transport data, as

14 We refer here to GoAscendal as formed in late 1992, through the merger of South Africa's GoMetro with the UK's Ascendal.

demonstrated by the efforts of Data Transport, the Safari-Njema Project, and the African Urban Mobility Observatory in several cities in Africa, and WhereIsMyTransport in cities worldwide.

- In Africa, eWarren Mobility, AddisMap, GoMetro, and KhartouMap – start-ups that have recently won the DT4A Innovation Challenge – have their own tech-based efforts to map informal transit in different cities, as a step toward improving transportation and providing reliable transit information to users.

- In Mali, the local OpenStreetMap Community partnered with Jungle Bus to create Transports au Mali, an initiative to map Sotrama routes to provide the citizens of Bamako with better information on the informal transport infrastructure in the city. The same mapping exercise was performed in Côte d'Ivoire, through the collaboration of Systra, Jungle Bus, Latitude Cartagène, and OpenStreetMap Côte d'Ivoire, to contribute to the digital commons in support of the Abidjan Urban Mobility Plan of the Ministry of Transport. Similarly, OpenStreetMap is also being used by Ally and the World Bank to map daladala[15] services in Dar es Salaam.

In both HICs and LMICs, shared-mobility app providers collect, store, own, and process statistical and mobility data within their platforms. Examples of these app providers include Uber, DiDi, Grab, FREE NOW, Gojek, Lyft, KakaoTaxi, and Ola. Shared mobility data is primarily in the hands of such private companies, because data collection is heavily interlinked with shared mobility operations. For ride-hailing and ride-sharing companies, real-time data is not only fundamental to how they operate, but also to how they continuously improve and expand services, even to the point of collecting information beyond mobility data. Surfshark (2022), a cybersecurity company, ranked 30 of the largest ride-hailing apps based on a data-sensitivity index that measured the amount of data monitored and collected by each app. Results show that the top three apps collecting the most types of data are Grab, Yandex go, and Uber. They collect non-transport data such as product interaction, contact information, user's photos and videos. Issues surrounding how this data is managed and protected are discussed in a later section.

4. Research and academic institutions

There are many research-led efforts, most of which are related to dissertations submitted in masteral or doctoral programs. This study does not include a list of all of the data-collection activities stemming from academic research.

We do, however, recognize some larger-scale research efforts, such as those of the **Centre for Transport Studies (CfTS) at the University of Cape Town**, led by Roger Behrens. CfTS has released TRANSITIONS –– Informal transport compendium report: A literature review to establish the 'state of knowledge' and appraisal of gaps requiring further research (Behrens et al., 2021). The report reviews "the state of knowledge in the field of informal public transport in sub-Saharan Africa" and

15 Local informal transport buses found in East Africa.

identifies "important gaps in knowledge from the perspective of formulating policy interventions with prospects" for delivering low-carbon, affordable and safe mass transport (Behrens et al., 2021, page 41). The research is funded by UKAid and FCDO through the High Volume Research program.

Research at **Stellenbosch University** on electric mobility and intelligent transport systems for paratransit modes are being led by Thinus Booysen, Professor in Engineering and Director of the MTN Mobility Intelligence Lab. His research focuses on e-vehicle technology, policy opportunities, and current challenges in the electrification of minibus taxis in Sub Saharan Africa, which are published alongside the GPS tracking data on minibus taxis used for his research work (Booysen, n.d.). The GPS tracking dataset is the first of its kind captured on a per-second (1 Hz) basis, and is intended to include micro-mobility patterns of minibus taxis, which have significant implications on energy consumption that are often excluded from regular data collection efforts due to "infrequent sampling" (Hull et al., 2022).

Researchers from the **Chulalongkorn University** in Bangkok[16] compiled a list of major transportation apps in Southeast Asia (SEA) as part of a paper surveying research on ride-hailing apps in the region (Chalermpong et al., 2022.) The Kajima Foundation provided funding for the research. The researchers shared that they intend to compile and investigate policies on ride-hailing apps in SEA for subsequent papers, and may include the aggregation of available mobility data.

For LMICs in Asia, there is an effort led by Japanese scholars to classify paratransit services in Asia, most of which operate with a level of informality. These services are being referred to as LAMAT services, which stands for Locally Adapted Modified and Advanced Transport (Phun and Yai, 2016). This term was formulated in the Asian context, in which many informal transport services use imported vehicles adapted to meet local transport needs (e.g., Philippine jeepneys). After local adaptation, these vehicles, which are heavily relied upon by the commuting public, are upgraded or modified to improve mobility services (ibid.). Data generated through LAMAT studies includes informal vehicle specifications, the impacts of ride-hailing apps on LAMAT services, the impacts of COVID-19 on LAMAT services, etc.

5. Gig workers[17]

Shared mobility (and goods delivery) gig workers have organized and are starting to collect their own data, to challenge the way the tech platforms price and assign work (Marshall, 2021). An article in WIRED explained their motivation: "...workers have been drawn to homegrown tools built by other gig workers—and the idea that they might themselves profit off the information that companies collect about them." In 2019, the Driver's Seat Cooperative was launched with the aim

16 In partnership with other universities in Asia, including the University of Tokyo, De La Salle University in Manila, and the University of Transport and Communication in Hanoi.

17 The US Chamber of Commerce defines gig workers as "independent contractors or freelancers who typically do short-term work for multiple clients. The work may be project-based, hourly or part-time, and can either be an ongoing contract or a temporary position." (Wingo, 2021, no pagination)

of helping workers collect and analyze their own data from ride-hail and delivery apps like Uber, Lyft, DoorDash, and Instacart. More than 600 gig workers in 40 cities tested the product, which empowered them to choose which platform they could use to make the most profit. The cooperative sells their data to transportation agencies, offering a glimpse of how this sector works. Only one city agency has paid for this service so far: San Francisco paid $45,700 for a local mobility study. (Marshall, 2021, no pagination)

- In London, a group of ride-hailing drivers won a lawsuit to get Uber to recognize them as workers and not "individual contractors," who have rolled out a data-collection strategy. They are using the European Union's (EU) General Data Protection Regulation (GDPR) rules to request the data from Uber and Transportation Network Companies (TNCs)(Athreya, 2021).

- In Hyderabad, India, Uber drivers are using messaging platforms like Telegram to share operational data such as surge pricing breakdowns and deduction calculations in order to protect themselves from unfair booking assignments produced by the Uber algorithm. "Information exchange is crucial because drivers have so little information about their job: why they're getting paid; what they're being paid; why they're being matched to certain orders; why sometimes they get a lot of orders, sometimes they get none," Rida Qadri, who studies algorithmic failures and frictions in the Global South, told Rest of World (Bansal, 2022, no pagination).

6. Professional associations

The **Boda Boda Safety Association of Kenya (BAK)** maps its members across the 47 counties of Kenya. Their members include service providers across passenger transport, courier riders, dealer shops, and private bikers (BAK, n.d.).

The **Global Labour Institute (GLI)**, based in Manchester, England, and the **International Transport Workers Federation (ITWF)** support an initiative that analyzes the micro-economies, occupations, and employment relationships within informal passenger transport in Nairobi, Dakar, Kampala, Accra, and Abidjan. The research focuses on the potential impact of large-scale transport investments (BRT, light rail, metro, etc.) on transport workers and the potential for "'worker-led' bottom-up steps towards formalization", with the desired outcome of reducing police harassment, improving working conditions, and gaining access to affordable capital.

GLI and ITWF are using participatory field-research methods, and are working with trade unions and associations that represent workers and owners. GLI (2022) has also launched a new project to produce and host a global guide to the informal transport economy. This includes urban passenger transport, goods delivery, railways, docks and ports, aviation, and tourism. The guide will be published. An online resource center (educational materials, research papers, policy documents, etc.) is also being developed.

7. Philanthropic funding

We did not find wide-scale investments on the part of philanthropic organizations in collecting mobility data in shared mobility or informal transportation. The foundations studied (such as Rockefeller Foundation for Digital Matatus) did provide grants for pilot projects and a few local projects. Nevertheless, the philanthropies were largely absent in multicity, regional efforts and efforts across wider geographies.

Philanthropic funding is more geared toward supporting research efforts that address informal transport, shared mobility, and related spaces. An example is the Ola Mobility Institute (OMI), which was launched by ride-hailing giant Ola. Ola's documentation indicates that a "specialized think tank has been set up to develop knowledge frameworks that will focus on the intersection of mobility and public good" and "on leveraging the 'disruptive' potential of mobility as a growth and innovation engine for India's economy" (Ola, 2018, no pagination). The OMI has identified six focus areas. Two of these, (1) Urban Mobility and (2) Future of Work & Platform Economy, have published research relevant to shared mobility. The Volvo Research and Education Foundation (VREF) has also supported a wealth of research covering informal transport and shared mobility in low- and middle-income countries, under the Future Urban Transport Program.

Table 3. Groups of organizations at the forefront of data collection efforts

Group Type	Examples of Organizations	Description
Multilateral and bilateral development agencies	The Asian Development Bank (ADB), World Bank (WB), German Agency for International Cooperation (GIZ), Agence Française de Développement (AFD), and Japan International Cooperation Agency (JICA)	These agencies include transport in their respective development agendas, most of which are centered on sustainable mobility initiatives. Efforts include the development of a transport database, financing sustainable mobility projects in developing countries through loans and/or grants, and supporting the formulation and updating of master plans across LMICs in Asia and Africa.

Non-governmental organizations	The Fundación Centro Para la Sostenibilidad Urbana (CPSU), Global Partnership for Informal Transportation (GPIT), International Association of Public Transport, Digital Transport for Africa (DT4A), Trufi Association, Amend, and the World Resources Institute	Efforts by these organizations are mainly financed by development aid organizations or international financial institutions. Many of their initiatives involve projects on informal transportation data collection, while others include the creation of open-source databases, either in partnership with other groups or through grassroots efforts with the aid of volunteers.
Private companies	GoAscendal, WhereIsMyTransport, Sakay.ph, eWarren Mobility, AddisMap, GoMetro, and KhartouMap, Jungle Bus, Uber, DiDi, Grab, FREE NOW, Gojek, Lyft, KakaoTaxi, and many others.	These companies are mostly start-ups that were established to fill gaps in the transport sector. Some have received funding to support research projects from institutions such as the World Bank, while others started in response to competitions hosted by other organizations, such as the Innovation Challenge spearheaded by the DT4A. Some of these companies are also shared-mobility app providers, which operate in both HICs and LMICs.
Research and academic institutions	Centre for Transport Studies (CfTS) at the University of Cape Town, Stellenbosch University, Chulalongkorn University, research on LAMAT services by Japanese scholars, University College London (UCL)-Bartlett, Columbia University's Center for Sustainable Urban Development, and MIT's Civic Data Design Lab	A huge fraction of the literature on informal transport and shared mobility comes from research and academic institutions, whose body of work includes dissertations submitted in masteral or doctoral programs. These studies contribute to data-collection efforts and aim to add to the existing body of literature that informs policy decisions in the sector, including the regulation of informal transport as well as the possible integration of informal transport into formal modes of public transport.

Gig workers	Driver's Seat Cooperative, Worker Rights Info Exchange, and other informal groups of drivers offering services through shared mobility apps	Gig workers working in shared mobility and goods delivery include "independent contractors or freelancers who typically do short-term work for multiple clients" (Wingo, 2021), Their clients include ride-hail and delivery apps such as Uber, Lyft, DoorDash, and Instacart. Gig workers supporting these companies have organized to collect their own data to challenge the way tech platforms price and assign work (Marshall, 2021). Information they have gathered can be used to help them decide which "gigs" to eventually accept.
Professional associations	Boda Boda Safety Association of Kenya (BAK), Global Labour Institute (GLI), and International Transport Workers Federation (ITWF)	These associations include service providers in the transport sector as well as professionals involved in labor and union work, such as the Global Labour Institute (GLI) based in Manchester, England and the International Transport Workers Federation (ITWF). The data-collection efforts of these groups include mapping their members (for service providers) and conducting research on informal transport (for other professional groups).
Philanthropies	Rockefeller, VREF	Philanthropic funding is focused on supporting research efforts that cover informal transport, shared mobility, and related spaces.

D. Zooming in on government

This research could not find significant information on national government agencies across the globe that are leading efforts to collect mobility data on informal transportation. The only instance where government-led efforts in informal transportation data collection is found is in the case of China, where information such as vehicle registration (i.e., e-bike registration) and data on the informal economy (i.e., transaction data) are being collected by the Local Traffic Management Bureau and the National Bureau of Statistics.

More cases were found in which governments engage or support research efforts in informal transportation. Governments rely on the private sector or NGOs to gather data for them, either through partnerships or through engagements as service providers. In the municipality of Santa Maria do Cambucá in Brazil, the government supported research by providing financial support for evaluating the level of user satisfaction with public transport services to support the development of transportation regulations (Leal de Almeida Nascimento and Oliveira de Andrade, 2020). Governments also contract academic institutions through bidding processes, and complement their work through support from their own staff, allowing access or permission to conduct surveys, and sharing networks. Initiatives of the African Urban Mobility Observatory have engaged government and academia to determine the role of informal transport in the Global South in enabling a transition toward clean, affordable, and efficient urban transportation solutions (Visagie et al., 2021).

There are also instances in which city governments are aided by the private sector, multilateral agencies, and other groups in collecting, mapping, and analyzing data to inform transport policy decisions and investments. Examples include: the case of Cap-Haïtien in Haiti, where the World Bank collected mobility data related to the operation of Taps Taps in the city, with the support of companies such as WhereIsMyTransport, Data From Sky, and Mobile Market Monitor; and Maputo in Mozambique, where Safari-Njema supported the Agencia Metropolitana de Transporte (AMT) by providing a scalable method for implementing and providing innovative modifications to the existing Transport Master Plan, and for elaborating their forthcoming National Mobility Policy.

In the Philippines, the national Department of Transportation (DOTr), via its sub-agency the Land Transportation Franchising and Regulatory Board (LTFRB), contracted Sakay.ph to become the "system manager" of the country's pilot service-contracting program for jeepneys (Fons, 2021). In response to the pandemic and under pressure from civic activists, the national government piloted a scheme to pay jeepney drivers a daily rate premised on completing their routes. The jeepneys were tracked via GPS over their smartphones.

Data on informal transportation collected by government sources commonly includes vehicle and franchise registration details. In Southeast Asia, many informal transport services operate under some level of regulation (Cassius, 2021). In the Philippines, for example, LTFRB is tasked with collecting vehicle and franchise registration data on informal transportation services to support enforcement of regulations.

A blog post from GoAscendal about its work on the African Urban Observatories describes the reality of transportation data collection on the ground. GoAscendal has observed that data collection investments, such as large-scale household travel surveys and traffic counts, are conducted if public agencies need to generate data to support investment projects such as a new metro or BRT. Otherwise, "these traditional data collection efforts cost so much that some cities rarely perform them, if at all! For example, Guadalajara (Mexico) conducted its last household travel survey 13 [15] years ago in 2007. Banjul (Gambia), like many African cities, has no such data at all." (Coetzee, 2020, no pagination)

There are data collection efforts that support loan programs funded by multilateral institutions such as the World Bank, IADB, and ADB. The Jeepney Modernization Program in the Philippines collected statistical data from informal transportation to include as elements of the country's Nationally Appropriate Mitigation Action (NAMA) for climate change (Mariano, 2021).

How shared mobility data is collected and aggregated (beyond the normal course of operations internal to private-sector service providers) in HICs and UMICs depends largely on the type of service(s) provided and how the government regulates the service(s). Apart from publicly-provided services (including services provided through contracts for on-demand transit provision, micro-transit and paratransit services) where a government agency stipulates access to data, most shared-mobility data is generated and held by private companies. Governments commonly aggregate statistical data collected when implementing permitting or procurement processes (i.e. when imposing a ceiling on the number of e-scooters and bikes allowed to operate in the city). The data is published, and higher levels of government or NGOs may aggregate the data.

Table 3. Overview of the role of governments in data collection

Role of Government
• Governments at all levels (city, regional, national) rarely lead data collection, but instead have a supporting role in initiatives and projects. The private sector or NGOs perform the data gathering, collaborating with governments through partnerships or regulatory oversight.
In Informal Transportation
• Some agencies at both national and local levels do not collect data on informal transportation because their policies do not require them to regulate services that are not formally recognized by law. The data collected usually includes the number of operated vehicles, and rarely does collection occur without initiatives taken by volunteers or private-sector actors. • China is the exception: the Local Traffic Management Bureau and the National Bureau of Statistics are collecting data on, for example, the number of vehicle registrations and the amount of internet-based transportation transactions under the bigger umbrella of the informal economy (Liu, 2019).
In Shared Mobility
• Governments have regulatory oversight over shared-mobility data that is mostly generated and maintained by private companies. Statistical data is aggregated by the government in conjunction with permitting and/or procurement requirements. There have been conflicts/negotiations between governments and private-sector actors regarding public-sector access to private-sector shared-mobility data.

E. Understanding purpose and motivation

In this section we examine the different motives and purposes of the aforementioned groups for collecting data. Findings from our research indicate that these can be classified into five general categories: for profit, for public investment, for regulation, for research, and for adaptation (in the context of COVID-19).

Start-ups, tech companies, and ride-hailing and ride-sharing platforms collect data to improve their business models. They also sell data to clients, including multilateral/bilateral institutions and national and local governments.

Multilateral and bilateral development institutions financially support countries implementing sustainable-mobility initiatives, through loans and/or grants that aid governments in formulating infrastructure roadmaps or creating urban-transport master plans at the metropolitan, city, and sub-city levels.

Governments mostly invest in data-collection efforts to inform policy decisions involving regulation, but only to the extent of their agency mandates. Where there is a lack of capacity, some governments partner with organizations whose main work involves collecting transport data.

Academic institutions concentrate their efforts to collect transport data on filling gaps in and contributing to the growth of the body of literature regarding the transport sector. This is especially true with regard to informal transport, where data is not easily available and accessible.

Interestingly, the onset of the COVID-19 pandemic has driven members of the informal sector to innovate and adapt, in order to continue providing their services to the public despite the lack of state support. These efforts have resulted in new categories of data for collection, with some paving the way for integration in digitizing transport payments. In Rwanda, for example, in response to public-health-safety concerns posed by COVID-19, Tap&Go extended digital payments from public buses to taxi-motos (Further Africa, 2021).

- For profit

  Private-sector entities collecting data on informal transportation are leading more complex mapping and route analyses. This is primarily in the form of consulting services that report on transport demand and recommend ways to make routes more efficient. Companies such as WhereIsMyTransport, Data From Sky, Sakay.ph, and Mobile Market Monitor have supported institutions such as the World Bank in research activities, while Sakay.ph similarly provided the Philippine government with route data and analysis as part of the government's program to modernize public-utility vehicles.

  Ride-hailing and ride-sharing apps continue to collect shared-mobility data and non-transport data to improve and expand services and compete with other ride-hailing apps and

services. Data collection is integral to the operations and profitability of these apps and services. Many of their business models include the use of data collected to support targeted marketing and advertising. For instance, in 2022, Uber launched its own "in-house advertising division" and "its own form of targeted digital ads as it seeks to develop new revenue sources" (Thorbecke, 2022, no pagination). For these companies, more data implies more competitive services and better avenues to profit.

- For public investment

  HIC institutions such as multilateral and bilateral development banks provide financial support for data collection and analysis on informal transportation, to inform infrastructure or policy projects. They support technical cooperation projects, such as infrastructure roadmaps and urban transport master plans, which also aggregate data at the metropolitan, city, and sub-city geographies. Such support helps to identify not only priority national infrastructure investments, but also projects and programs that are feasible for receiving ODA. For development banks, collected data supports efforts to meet lending and development targets.

- For regulation

  Governments collect data based on their mandates. Following legal mandates or institutional partnership mandates, government agencies collect data to support the implementation of regulations over transport services. The data required is therefore commonly limited to information needed to perform regulatory functions (i.e., vehicle registration details, franchise information, etc.), especially in LMICs where transport agencies often lack the resources to collect data for planning purposes. Further information regarding the role of governments in data collection is provided in Section F of this chapter.

- For research

  Academic institutions collect research-based data for knowledge creation. University-based and institution-based efforts to collect informal and shared-mobility data support improved understanding of specific research topics. This implies that many datasets collected or organized by academic institutions tend to be small in scale and often follow statistical sampling principles.

- For adaptation: COVID-19 as a catalyst for data collection in UMIC, LMIC and LICs

  Despite the lack of state support, the informal transport sector in UMICs, LMICs and LICs innovated to adapt to the new economic conditions and safety needs spurred by COVID-19. In Mexico City, colectivo drivers have shared routes — and income — to adapt to reduced demand while keeping services running. In Nairobi, Matatu drivers have partnered with Safaricom, the company behind Kenya's mobile payment M-PESA, to transition to contactless fares, while in Rwanda, Tap&Go, a tech firm enabling payments in public transport, included taxi-motos

in their digitization of transport payments. In other cities, informal transport operators have found creative ways to enforce social distancing: Manila's Jeepney drivers have placed juice boxes between passengers (Panti, 2020), and Gurgaon's e-rickshaw drivers have installed plastic shields (Viswanath, 2020).

Table 4. Overview of data motivations

In Shared Mobility
• Shared-mobility data collection (outside company operations) motivated by government oversight for planning, regulation/compliance and/or fee collection. • Real-time routes, frequencies, O&D
In Informal Transportation
• Informal-transportation data collection motivated by a desire to reveal the extent of transportation networks and routes • Number of operators, routes, demand behavior, GTFS Management Bureau and the National Bureau of Statistics.

F. Looking beyond data collection and management

This section discusses the different ways in which mobility data is managed in HICs, UMICs, and LMICs. In these countries, the private sector is heavily involved in data collection and management, which informs decisions regarding business operations. Regulations requiring private companies to share such data with public-sector entities has resulted in conflicts, because data sharing with governments can result in lower profits for mobility service providers when the data is used to improve public transport services.

Our findings indicate that governments mostly require data to be shared by the private sector when private companies are involved in public transport operations, either through the outsourcing of operations or through public-private partnerships (PPPs).

There are also differences in how governments use and regulate mobility data. While there are no regulatory requirements at the federal level in North America, shared mobility data owned by app providers is usually shared and used by the government in China and in some countries in Southeast Asia.

Data on informal transport is extremely limited, and where available exists in silos. The private sector usually leads data collection activities on informal transport, to provide tech-based solutions to existing transport problems and to offer their services for a fee. Because of this, groups such as DigitalTransport4Africa (DT4A) and Data Transport have advocated for open-access data,

aggregating data across cities, and providing standardized and open urban mobility data that is accessible to the public.

In HICs and UMICs, shared-mobility data is collected and owned primarily by the private sector, with varying degrees of transparency. Research based on mobility data provided by shared-mobility companies (assuming the data is not intentionally redacted to protect the company) will normally provide a complete or nearly-complete picture of the service, as the service could not operate without the data. There are ongoing regulatory battles to require platform and app companies to provide their data to governments.

There are regulatory conflicts regarding government access to private-sector mobility data, especially for data generated by private services where the government does not own a stake (Braw and Palazzolo, 2021). These include permitted operations (see TNCs such as Lyft, Uber, or sharing pooled rides such as BlaBlaCar). Shared-mobility operators are able to pinpoint where customers are waiting at a given time and where drivers are cruising around cities. Their data is collected primarily to track supply and demand, allowing them to implement surge pricing (the boosting of fares) at peak times. When shared with the government, this data could be used to increase public transportation options, as it indicates where demand is highest at any given time.

Private companies and NGOs have responded by advocating for data standards, data interoperability, and standardized APIs (application program interfaces). They include groups like MobilityData (curators of GTFS, GBFS, and GOFS data standards), Open Mobility Foundation (proponent of the MDS standard), and SharedStreets.io (which seems to be in hiatus). The California Integrated Transportation Project (Cal-ITP), which is part of CalTrans (the state-level transportation agency in California), advocates for Mobility Data Interoperability Standards. Interoperability data standards and APIs are essential to the development of Mobility-as-a-Service (MaaS) operations.

The EU requirement for the sharing and interoperability of mobility data through National Access Points (NAP) and MultiModal Travel Information Services (MMTIS) as required by Directive 2010/40/EU is an example of interoperability requirements[18]. Our scan found that local or metropolitan governments usually formally require shared mobility data from services where the government outsources operations (see micro-transit or shuttle operations) and/or where operations are PPPs (see bike-sharing in New York, Berlin, London, etc.).

We found no comparative regulatory structures or requirements at the national (federal) level in North America.[19] In the U.S., federal transportation agencies aggregate statistics in terms of geography and fleet counts.

18 Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport.

19 We are aware of failed efforts to require "data commons" for shared mobility in certain jurisdictions in the US, but were unable to find adequate documentation of them. The efforts we are aware of failed due to resistance

In China and Southeast Asia, we found cases in which shared-mobility data owned by mobility app providers is shared and used by government agencies or research institutions. In China, the government requires real-time data sharing following a set of data sharing protocols for security regulation purposes. Research institutions benefit from the availability of this data. For example, in Shenzhen, studies at the Department of Automation in Tsinghua University found that shared mobility has is not just used as a first- and last-mile option, but has completely overtaken the routes that customers use to get to some locations (Tang et al., 2021). Many such studies have shown that shared-mobility services directly compete with bus and metro transit as well as taxi operations.

In Southeast Asia, mobility app providers often take the initiative to share data with government and academic institutions for research purposes. Unlike China, SEA governments do not have established data-sharing agreements with mobility app providers. In China, government-collected data on shared mobility (and informal transport) is done under the larger umbrellas of shared and informal economies. The data collected and shared is mostly economic, such as market shares, penetration rates, revenue generated, etc.

Shared-mobility data for SEA countries (Philippines, Cambodia, Indonesia, Malaysia, Thailand) generally includes origin and destination data, transport surveys, demand data and analysis, mobility and fare data, transportation patterns and measurement of traffic congestion levels in specific areas, and vehicle registration data, among others.

Shared mobility data, when collected and made available to government agencies, is not being aggregated for geographies larger than metropolitan areas. Any cross-country efforts led primarily by private companies are restricted to cities where the companies operate.

Furthermore, **data on informal transportation remains extremely limited**. The data that does currently exist occurs in silos. Our findings show that data collection on informal transportation is usually led by consulting or tech companies and groups implementing projects and initiatives funded by academia and multilateral agencies. An example of a private-sector company that collects data on informal transport is Sakay.ph, which provides journey-planning information for commuters in Metro Manila, Philippines covering both formal and informal services. There is a rise in collective efforts by groups such as WhereIsMyTransport and the Safari-Njema Project that are focused on gathering and analyzing informal transportation data in Africa, with the aim of advocating for better mobility policies for the sector.

To address these limitations on the availability and access of data, groups in Africa such as DT4A and Data Transport have launched initiatives to advocate for open-access data and to aggregate data across cities in the region by providing a platform where standardized and open urban-mobil-

from TNCs or questions about data privacy protections. (One particular question was whether data could be released under Freedom of Information requests.)

ity data can be easily accessed by anyone. Data provided by these groups include routes, transport stations, GTFS, airports, parking, and station services, among others.

Table 5. Overview of how data is managed

In Shared Mobility
• In HICs and UMICs, shared-mobility data is collected and owned primarily by the private sector, with varying degrees of transparency. Governments mostly require data to be shared by the private sector when the government is involved in transport operations, either by outsourcing operations or through public-private partnerships. • In China and Southeast Asia, shared-mobility data owned by mobility app providers is shared and used by government agencies and research institutions.
In Informal Transportation
• The private sector usually leads data collection activities on informal transport to provide tech-based solutions to existing transport problems and to offer their services for a fee.

G. Summary of main findings

Firstly, stakeholders (be they private companies, NGOs, governments, etc.) collect data primarily on shared mobility and informal transportation in cities with large populations. Major metropolitan areas and national capitals have levels of economic activity, the presence of large academic institutions, and start-up business cultures that stimulate such data collection. There are data gaps for secondary and tertiary cities, where informal transportation is more heavily used on a per capita basis.

Where shared mobility operators exist, data is collected, especially when operators utilize digital tools (such as apps). We have also observed that shared-mobility data collection is concentrated in HICs, and collected data is used, published, shared, etc. by different stakeholders to a greater extent in HICs than in other regions.

While informal transport data collection largely occurs in LMICs where informal transport is more prevalent, we did find instances of informality documented in HICs for specific cases, such as immigrant-based migration from LMICs to HICs. However, informal transport cases serving specific populations in HICs are not widely reported or documented.

Our study covered most geographies, but lacks cases across Central Asia and Eastern Europe, MENA, and French- and Portuguese-speaking Africa for both shared mobility and informal transportation. We have identified numerous data resources on logistics, shipping, and freight in Central Asia and Eastern Europe.

Most of the information gathered focused on mobility data, i.e., mapping routes against available street-network data. This is data that can be gathered through location and tracking apps on mobile phones.

Globally, both shared-mobility and informal-transportation data collection is financed primarily by multilateral institutions and private companies from HICs. The act of data collection itself is performed primarily by local NGOs, regardless of the source of funding. This is especially true in LMICs and LICs, where in some cases, the NGOs themselves are not granted access to the data that they help to collect.

Academic data collection exists primarily to support theses and dissertations, and is therefore usually collected on a short-term basis, with researchers noting difficulty in accessing available data held by multilateral institutions and private companies.

Given the findings above, there is an opportunity for governments, globally, to exert their power as prime movers in addressing the critical task of identifying and filling gaps in mobility data collection. Governments create policy structures and develop and implement projects related to shared mobility and informal transportation. Given the resources and technical capacity required, governments, whether at the city, regional, or national level, are particularly well positioned to lead transport data-collection activities. Doing so would improve mobility planning, decision making, and access to transport services.

IV. Areas for Further Research

The data-collection efforts described above and in other reports identified while carrying out this research pointed to some possible research gaps. In the following section we expound on these gaps and propose research areas that merit further attention and support.

A. Data-reporting protocols

In general, the initiatives and projects that were reviewed provided limited information on the types of data being collected. Although we enumerate in Section A of Chapter 3 the types of data relevant to shared mobility and informal transport, it is difficult to determine which data types are being collected by specific groups. There is limited information on what actual data fields are being collected through private and academic efforts. As such, it is difficult to determine with absolute clarity what "gaps" may exist in the data collection.

Projects under DT4A and DATUM likely collect similar data in similar formats. This likely holds true for other projects using standardized data formats (i.e., GTFS, GTFS-RT) and using the same

platforms (i.e., OpenStreetMap) as well. Outside route-mapping activities, cross comparisons of available data indicate that the initiatives collected similar data but in different formats.

GTFS mandates the transmission of the data in Table 6. GTFS was designed for agency-led services, and many of the data fields are not applicable to shared mobility or informal transportation, such as the definition of headways or dates of service.

Table 6. Types of GTFS Data

Data/Dataset	Description
Required	
Name of agency	Transit agencies with service represented in this dataset.
Stops	Stops where vehicles pick up or drop off riders. Also defines stations and station entrances.
Routes	Transit routes. A route is a group of trips that are displayed to riders as a single service.
Trips	Trips per route. A trip is a sequence of two or more stops that occur during a specific time period.
Stop times	Times that a vehicle arrives at and departs from stops for each trip.
Conditionally required	
Service dates	Service dates specified using a weekly schedule with start and end dates.
No service dates	Exceptions for the service dates
Optional	
Fares	Fare information for a transit agency's routes.
Fare rules	Rules for applying fares for itineraries.
Shapes	Rules for mapping vehicle travel paths
Headways	Time between transit vehicle arrivals at a stop (time between trips) or a compressed representation of fixed-schedule service

Transfer Rules	Rules for making connections at transfer points between routes.
Pathway (Links)	Pathways that link together locations within stations.
Feed Metadata	Dataset metadata
Dataset Metadata	Dataset attributions

Mobility datasets collected using the GTFS would likely contain the above data.

MobilityData and its members are developing a General On-demand Transit Feed Specification (GOTFS). As its name implies, the GOTFS is being designed for on-demand services, and will likely be applicable for both shared mobility and informal transportation.

That said, lack of a **reporting protocol** or an agreement for standardizing the type of information being collected is a definite gap. This gap is particularly important from an ethical research standpoint, considering that mobility data contains information that can be tied to individuals (Kanowitz, 2019). There is also a lack of reporting on the status of the data collection and not all projects are offered as open data or provide avenues for accessing the data that has been collected.

B. Regional documentation

This research aims to not only illuminate what data is collected, by whom and how, but also to identify specific geographies that have not been studied sufficiently. Where did we not find information? Data on informal transportation in Central Asia and Eastern Europe is sparse, with the bulk of the data that we identified focusing on shipping, freight and logistics.

As mentioned in the previous section, data collection is highly focused on cities, with limited coverage of peri-urban and rural areas.

C. Secondary- and tertiary-city data-collection efforts

Most of the data collection activities that we identified were being carried out in **primary cities**, such as national capitals and major metropolitan areas. In LMICs, this is likely due to the presence of larger universities and research institutions in the primary cities as well as the presence of startup companies and startup ecosystems.

There tend to be **larger data gaps in secondary and tertiary cities** in LMICs, where informal transportation is usually more prevalent in number and in use in these cities. **The existing data is also**

generally limited to cities in countries where development finance institutions are interested in investing in information-collection activities.

D. Expanding the definition of "data"

Most of the information gathered on informal transportation has focused on mapping routes against available street network data. Such data can be gathered through location and tracking apps on mobile phones.

Statistical data is harder to collect, so few of the NGO-led efforts do. Statistical data can answer foundational questions such as: How many informal transportation providers are there in this city? What types of vehicles are driven? What is the age of those vehicles? What are the vehicle emissions levels? What are the service providers' business models? What are the permitting and regulation schemes? This type of information is critical for understanding informal transportation systems and their operations.

Data on informal transportation includes indicators beyond statistical and mobility data. Traditional mobility data is used to drive investment, regulation, and policy development. However, informal transport allows us to expand our definition of what data is and how it can be used, given that informal transport can also be seen as a social network, a huge SME industry, and is used to move more than just people. Therefore, it could be useful to extend data indicators for informal transportation beyond those used for traditional transportation.

The informal transportation industry is organized into different groups of formal and informal networks that define the operations and management of the ecosystem. Informal transport operators seek to gain and maintain access to urban spaces necessary for their operation in informal, and sometimes illegal, ways. Spatio-geographic data for stops, depots, parking, among others, look very different for formal transportation as a result of daily negotiation and "co-regulation" by associations of operators and drivers, in addition to the behavior of users.

What qualifies as being considered transport data can be further expanded to include indicators beyond statistical and mobility data, especially in the context of informal transport. Other crucial data points that are not currently considered may be important for understanding how informal transport systems operate. Furthermore, better data and data-collection practices can strengthen equity and sustainability in urban transport, leading to a just transition and transformation of the informal transport sector and increasing transparency and accountability in mobility data sharing between the public and private sectors.

E. Collecting information about policies, regulations, and other government efforts

Globally, there are limited examples of governments that collect data on informal transportation other than vehicle registrations/violations. There are a few efforts to collect information about policies and institutional arrangements that govern shared mobility and informal transportation. One example that we identified is the The one exception was the SUMC-NUMO database of Micro Mobility Policies.

We found no studies on shared mobility or informal transportation business models in HICs or LMICs.

It is unclear if the city-level data-collection projects that we identified, particularly for mapping routes, were one-time or continuous efforts. In addition, no data was available on the institutional capacity of government agencies to manage mobility data. Based on feedback from contacts within groups mentioned in this report, we also identified a prevalent concern that **government agencies do not have the capacity and resources to collect mobility data**, much less to update and maintain databases on a regular basis.

F. On transparency

Shared mobility is becoming an increasingly important component of the transport sector, yet most of the data on shared mobility is privately owned and maintained, with limited (if any) agreements or protocols for sharing data with regulatory agencies.

More insight on the impact of transparency issues in data-collection is needed. How does a lack of transparency may contribute to regulatory capture? Does this lead to biases in the processes, algorithms and methods for collecting and analyzing mobility data? Is the private sector reluctant to share data with governments, and if so why?

Governments have an opportunity to establish and enforce data-sharing protocols and provide regulatory oversight on data collected by tech-based platforms, but what challenges do they face?

G. On ethics guidelines

We also found very little guidance on ethical approaches to collecting mobility data, particularly for informal transportation. The lack of information on what data is being collected also means a lack of information on which data points were selected for collection and why. This obviously creates concerns regarding the omission of data that may be important to the providers and users of informal transportation.

H. Mobility data that reflects cultural diversity

Mobility serves diverse needs and populations. The data currently being collected does not reflect this diversity. Emerging areas of study identified in our scan include:

- Motorcycle-based informal transportation;
- Island, water-based informal and shared mobility;
- Bike sharing;
- E-mobility; and
- Study of the language, design, and culture of informal transport.

I. Informal transportation data that contributes to decarbonization

The assets: Informal systems are not just modes of transport but small businesses. We do not know enough about service providers' primary assets: their vehicles. This matters, because if we want to bring about change at scale (i.e., through vehicle electrification), we need data on how to do it.

When new transportation systems are being planned, discussions regarding scrapping of vehicles used to provide informal transportation often arise. There has been evidence of this in Johannesburg, Bogota, and Manila, when BRTs were being planned. Studies on scrapping potential are usually funded by multilateral funding agencies such as the World Bank, AFD, and JICA.

Labeled as "fleet modernization," supporters of scrapping commonly argue that informal transport service providers use old vehicles that produce 10 to 15 times more pollution than modern buses, and should be replaced immediately. Oftentimes, the fact that there are more private vehicles than informal transport vehicles on the road, producing more pollution, is neglected.

Interestingly, in our research we have seen studies, projects and lobbying related to e-mobility. Scrapping vehicles has a potential to contribute to decarbonization of the transport sector, which could be amplified with a nudge toward space-efficient and cleaner transport, such as electric vehicles (EVs) and electrified public transport.

Air pollution and climate change: Data collection on greenhouse-gas emissions and local air pollutants from informal transportation is a key concern. Low-cost sensors and predictive analysis using GPS trackers have been employed in an attempt to provide reliable estimates of emissions, but these are not sufficient to provide a robust depiction of the local air pollution and climate change impacts of informal transportation.

These environmental impacts have also been used to argue for the removal of informal transportation services, with the justification that they pollute more than private cars and shared mobility.

Inclusive data collection that is not influenced by a biased political agenda could contribute to creating a pathway toward sustainable and decarbonized transportation.

E- mobility: Harnessing the potential to electrify public-transport buses (as well as ride-hailing vehicles) requires access to data. Data is being collected regarding batteries, charging infrastructure, etc. China has a comprehensive data-tracking center for EVs (Transport Planning and Research Institute and GIZ, 2022). As an emerging field of research, additional open-source data collection on e-mobility, improving management of internal combustion engine vehicles, and exploring the development of new fuels is needed.

J. Role of advocacy in driving data collection, analysis, and use

More and more NGOs collect data to advocate for improved access to mobility solutions and improved transport services. Groups like ITDP use data to support their core business activities (i.e., as consultants creating service plans), but also for advocacy work.

NGOs also initiate and foster the formation of active and collaborative networks among organizations in the informal transport sector, provide capacity building support, and push for the consideration of the data that they collect in the development of local and national planning and policies.

It is unclear if there are mechanisms in place to regularly update statistical and mobility data collected by NGO. Current NGO data-collection efforts may be one-off activities if their projects do not receive sustained funding.

K. Data and marginalization

Health data for transport workers, especially in the informal sector, are overlooked. They are exposed to particular environmental, societal, and health hazards related to their informality and legality. Quality-of-life, stress-levels and work-ability data of shared mobility drivers and informal transportation drivers are significantly less than data of formal transport.

With respect to gender and gender identity, women and LGBTQIA+ individuals have different mobility needs and patterns than those of men. Transport policies and planning need to acknowledge this, and access to data can support that development. Often, data collection is gender-blind or assumes that the user is an able-bodied man, or excludes the collection of data specifically on women. In the web of networks for informal transportation systems, women play roles that need to be documented.

Power dynamics also play into what data gets collected and who gets counted. The lack of gendered data reflects the absence of women and LGBTQIA+ from transport policy decision-making spheres. Additionally, informality sometimes means living in the shadows: informal transport ser-

vice providers exist and work in a context beyond what is defined as legal. With respect to transportation planning, the lack of data on informal transportation routes may reflect governments' neglect of needed investments and planning. Collecting more data would enable highlighting inclusivity and access, especially for the poor who are often excluded from services altogether in privately-run systems.

L. Broadening academic scope

Apart from providing additional contributions to the literature on informal transportation, some governments engage academics to conduct studies to support programs that aim to help other governments develop their transport-planning and data-collection capacities. In other cases, agencies may actively engage with academics in an active effort to develop their own capacity in data collection and analysis.

There is a divide between academics who author research, NGO leaders who implement development activities, and those who work within or to support transportation systems. We advocate for creative, collaborative, and long-term-oriented research involving community engagement where academics and industry professionals are encouraged to engage in research beyond the traditional sense of transportation studies and more frequently adopting the methodologies of anthropology, sociology, and economics.

V. Toward closing gaps

In this research study, we endeavored to map existing data and data-collection efforts in the areas of shared mobility and informal transportation, and to identify areas where further study would add value for a variety of stakeholders. Given the breadth and diversity of the gaps in both data and data-collection efforts that we identified, improving data-collection efforts, with respect to quality, extent, breadth and scope, would add significant value to transportation policy and planning and formal and informal transportation service providers, and in the long run would result in improved mobility services for communities and their citizens.

Without access to more and better data, it will remain difficult to create a complete picture of shared-mobility and informal transportation systems as they exist. This may lead to faulty analyses and the adoption of inappropriate solutions. It also hinders comparisons across systems and geographies, which are necessary to learn valuable lessons and uncover important opportunities.

Addressing these gaps will require a range of solutions. Further discussion on how to close gaps is needed. However, an overview of possible approaches is outlined below:

Considerations for shared mobility

Data standardization would improve system interoperability and data-management practices. Moving beyond voluntary compliance and data sharing to specific protocols would help to achieve scale.

For shared mobility in UMICs and HICs, the current efforts in the EU to create **National Access Points** will probably solve the gaps in reporting. The MMTIS (Multi-Modal Travel Information Services) will also require the standardization of data formats.

In Canada and the US, the continuing work of **groups advocating for data standards** and interoperability will also close the gaps, especially if regulatory agencies at the local and metropolitan levels promote the application of the standards as prerequisites for permitting and operations.

In 2016, the World Bank launched **The Open Transport Partnership**,[20] with the participation of three ride-hailing companies: Latin America's Easy Taxi, Southeast Asia's Grab, and France's Le.Taxi.

The Partnership was an initiative "to make traffic data derived from [the ride-hail companies] drivers' GPS streams open to the world, under an open data license. The collaboration will empower resource-constrained transport agencies to develop better, evidence-based solutions to traffic and road safety challenges."

The partnership included nonprofits such as WRI and NACTO, traffic tech company Miovision, Android GPS company NDrive, and the open source mapping company Mapzen.

Linda Bailey, then Executive Director of the NACTO said, "Access to high-quality trip data is a substantial hurdle to our member cities in making informed decisions on transportation infrastructure and policy, especially in light of the quickly changing dynamics in transport service provision. The Open Transport Partnership will provide cities with the much-needed tools to understand traffic patterns and plan for better mobility."

Mapzen was expected to serve as the map and data platform for the project. ACP sources said the World Bank had provided significant resources to Mapzen. But the initiative did not progress far. Anecdotes shared with ACP by primary sources involved with the Partnership said the initiative stalled completely after Mapzen shut down operations in 2018.[21]

Mapzen's platform assets have since been absorbed by the Urban Computing Foundation. UCF's participants include "developers from Facebook, Google, Senseable City Labs of MIT, HERE Technologies and Uber." ACP could not determine if any of the elements of the Open Transport Partnership were continued or if any data was actually collected.

In 2021, the Bank's Sustainable Mobility for All (Sum4All) program released a report on Sustainable Mobility: Policy Making for Data Sharing. The report "provides actionable policy guidance on how country decision-makers can create a just, ethical, secure, and trusted data-sharing ecosystem and harness new opportunities for sustainability."

20 The World Bank Launches New Open Transport Partnership to Improve Transportation through Open Data. December, 2016.

21 Mapzen's platform assets have since been absorbed by the Urban Computing Foundation. UCF's participants include "developers from Facebook, Google, Senseable City Labs of MIT, HERE Technologies an Uber." ACP could not

Considerations for informal transportation

Given the short list of funders supporting the collection of mobility data from informal transportation, the best leverage point for closing the gaps described above would be the development agencies and international finance institutions. They can fund the collection of statistical data that is not easily connected via apps (mapping data), and can also invest in the capacity of city, regional and national governments to regularly collect and update statistical and mobility data about informal transportation. Governments could use mobility data to improve services and better target subsidies and support. The information collected could include real-time data on pickups and dropoffs, origins and destinations, passenger counts, and speed (and by implication, congestion).

As mentioned previously, further work needs to be done to develop indicators that explore the diverse services provided by informal transportation, as well as a better understanding of the different business models and factors driving business development.

Continuing to fund and increase efforts such as DT4A and DATUM could also lead to shared standards and shared efforts to close gaps, with specific resources devoted to gathering data from **secondary and tertiary cities and rural areas**.

Development agencies and multilateral institutions should invest in **convening** the leaders behind these data-collection efforts from around the world. They should also invest in building a **community of practice** and defining the skill sets and institutional capacities necessary to plan the collection and management of mobility information. The community of practice could also take on the propagation of ethical standards for data collection.

For both shared mobility and informal transportation, academic and other research institutions need more support to pursue new knowledge and continue to capture and champion more case studies and perspectives on this issue. Protocols for sharing publications, theses and dissertations across departments and among institutions would help cultivate a more comprehensive perspective. Similarly, research findings can be made available through open-source access to publications, to improve dissemination.

Moving toward an ethical, equitable, sustainable future

Who counts what? What counts where? Our scan revealed a spectrum of cases across economies, geographies, and contexts. It examined factors that influence the type of data collected and the uses they serve. It is clear there are many opportunities to improve what data is collected and how data moves beyond project-based work to contribute to larger transportation agendas.

To be intentional about data collection, we have to be more conscious about what data really is needed, why it is being collected, who collects it, and how it is used. Data collection can be extrac-

tive if it doesn't eventually benefit the people from whom it is collected. Moving forward, an ethical framework could be developed and adopted to guide data-collection efforts and ensure that the methods used and outputs produced help shared-mobility and informal transportation services to become equitable and sustainable systems.

ANNEX A

Data Sources for Shared Mobility and Informal Transport

Shared Mobility			
Data Source	**What's being collected?**	**Who is collecting and funding it?**	**Why is it being collected/ How is it used?**
ITDP Bicycle Sharing Database	A global database of urban bike-sharing projects (but predominantly covering Chinese cities). Qualitative and quantitative system information, such as bike trips per day, fee structure, operator, type of bike used, etc., is being collected.	Institute for Transportation & Development Policy (ITDP)	Illuminates differences in bike-sharing systems globally.
China Sharing Economy Development Annual Report	Economic data on shared mobility as a sub- sector in the shared economy	State Information Center (China)	Provides a view of the market share of shared mobility in China.
Company-owned shared mobility data	All information collected on ride hailing applications (e.g., origins and destinations, trip costs, trip frequencies)	Ride-hailing companies such as Didi, Caocao, Ola, Grab, GoJek, etc. In South and Southeast Asia, an estimated 79 applications are operational.	Provides a complete picture of shared transport within service areas of each application.
Tembici bike-share data in Brazil and other Latin American countries	Foot traffic, population density, car traffic, proximity to cycle lanes and bus stations, and first- and last-mile entries and exits of service use	Otonomo Technologies, in partnership with Tembici	Data collection to improve services, find micro-mobility "hotspots" and generate insights for data-driven decisions for expansion

US public database on docked bike-share ridership and an ArcGIS dataset layer on jurisdictions with bike-share and scooter-share systems	Geographic data (limited to presence in towns or cities), type of service (docked or dockless), and ridership levels (number of rides) for bike-share and scooter-share systems in the US	US Bureau of Transportation Statistics	Documents differences in systems and levels of patronage of bike- and scooter-share applications in the US
MobilityData	List and map of agencies (places) that offer data feeds in GTFS or GTFS-RT format	MobilityData and its members, through OpenMobilityData.org	
Shared-Use Mobility Center	Shared mobility profiles of the 50 largest metropolitan areas in the US, including data on availability of bike shares, e-scooters, and car-sharing, as well as links to regulations on dockless bikes	Shared-Use Mobility Center (SUMC), first funded by IGO CarSharing	Documents differences in systems for bike-, scooter-, and car-sharing applications in the US
Micro Mobility Policy Atlas	Database of more than 100 micro-mobility policies and regulatory frameworks from over two dozen countries	Shared-Use Mobility Center (SUMC), in collaboration with NUMO and World Resources Institute (WRI)	Documents policy case studies of micro-mobility applications, globally
Informal Transport			
Data Source	**What's being collected?**	**Who is collecting and funding it?**	**Why is it being collected/ How is it used?**
Internet Economic Statistics System (IESS) surveys	Transaction data of informal transport services conducted on mobile apps	National Bureau of Statistics (China)	Provides a view of the market share of informal transport in China. A caveat here is that much of the informal transport data is often lumped together with formal services.

E-bike Registration	E-bike ownership details, total number of e-bikes on the road	Local Traffic Management Bureau (China)	E-bike taxi patronage may increase alongside increases in e-bike registrations
Vehicle/Franchise Registration for informal transport vehicles (e.g., jeepneys, tricycle, and motorcycles)	Vehicle ownership details, operator or franchise details (if applicable) total number of vehicles on the road	Transport regulatory agencies in SEA. (Example: the Land Transportation and Franchising Regulatory Board in the Philippines, which is the agency in charge of regulating jeepney operations)	Vehicle and franchise registration data is used by government agencies to monitor and control the operations of said services.
Presence of e-bike taxis in China	Estimates of e-bike taxi prevalence around Metro stations in Shenzhen, China using street view on Baidu Maps	Research-based • City University of HongKong • Federal University of Bahia	Used to understand built-environment factors that possibly influence the presence of e-bike taxis in Chinese cities
Sakay.ph	Provides route data for informal transport services in Metro Manila	By Implication, Inc.	Provides map information on informal transport services such as jeepneys and UV express. Used as a commuter guide for Metro Manila, Philippines.
Tap tap services in Port-Au-Prince, Haiti	Socio-demographic information, labor market participation, and technical questions related to vehicles	Research paper funded by the Inter-American Development Bank	Conducted to contribute to literature on transport in the Caribbean and to address the knowledge gap involving the complexities of informal transport in Caribbean cities
Mapping urban mobility in Cap-Haïtien, Haiti	General Transit Feed Specification (GTFS) maps of Tap Taps; transportation patterns (O-D) and measurement of traffic congestion levels in specific areas	World Bank, with the support of WhereIsMyTransport, Data From Sky, and Mobile Market Monitor	Conducted to fill data gaps in transport services and to map urban mobility to support government and inform future policy and transport investments

Informal rural transport in the northeastern municipality of Santa Maria do Cambucá, Brazil	Socio-economic profile of informal transport users, trip purpose, trip evaluation	Research conducted with the support of CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) Foundation, a Brazilian federal government agency under the Ministry of Education	Evaluation of the level of user satisfaction, to support regulation proposals
Analysis of the demand behavior in the informal minibus sector in Antananarivo, Madagascar	Demand data and analysis for paratransit minibus services, called "taxi-be," within and around the city, with a data sample comprised of about 3,300 paratransit users gathered from a minibus user survey	World Bank	A policy research working paper produced to contribute to the literature on informal transport, as part of a larger effort by the World Bank to provide open access to its research and contribute to international development policy discussions
Tap&Go	Mobility and fare data for taxi-motos	AC Group in Rwanda	Digitization of payments in public and informal transport
Data Transport	Transit data	With support from the World Bank, through the Global Facility for Disaster Reduction and Recovery (GFDRR) - for the case of Bamako, Mali	Mapping of public and informal transport in Bamako, Mali
WhereIsMyTransport	Public transport data (Transit Data, Point of Interest Data, and Real-Time Alerts), focusing on informally-run public transport in emerging cities globally	Clients include the World Bank for a study to evaluate access to the informal economy in African cities	Consumer applications, urban planning, transport impact evaluation, infrastructure feasibility evaluation, site selection and geo-marketing, economic indicators

Safari-Njema Project	Spatio-temporal information, GPS data, O-D matrices, health facilities, High Resolution Settlement Layer (HRSL), OSM road network, financial services, Google Earth imagery, Performance Measurement System for Formal Mobility and Paratransit in Sub-Saharan Africa	Politecnico di Milano	Supporting paratransit mobility in Africa through big data analysis; supported the Agencia Metropolitana de Transporte (AMT) by providing a scalable method for the implementation and innovation of the current Transport Master Plan, and for the elaboration of their forthcoming National Mobility Policy.
African Urban Mobility Observatory	Mobility - distance travelled per person, mode share, period of travel, transfers, travel time, accessibility Experience - condition of PT vehicles, crime on PT, driver behavior, PT comfort & reliability, sexual harassment, affordability, traffic fatalities Efficiency - vehicle occupancy, CO2 emissions, congestion	The United Kingdom Foreign, Commonwealth & Development Office (FCDO), as a component of the second phase of the High Volume Transport (HVT) Applied Research Programme	Determining the role of informal transport in the Global South to enable transition toward a clean, affordable & efficient solution for cities
Mapping the informal transport network of Abidjan, Côte d'Ivoire	Service schedules, location and name of stops, track and route, observed speeds, vehicle occupancy, etc., across land and lagoon transport networks	Agence Française de Développement (AFD) provided the technical and financial support to Côte d'Ivoire's Ministry of Transport. Data collection was done through the collaboration of Systra, Jungle Bus, Latitude Cartagène, and OpenStreetMap Côte d'Ivoire.	Digitizing transport networks in open-source data formats to contribute to digital commons

Urban Age	Assembles comparative data and visual information on how global cities perform on key mobility, spatial, social, economic and environmental indicators	London School of Economics	Contains a section on the critical role of informal transport, as it covers more routes than formalized public transportation funded by governments
Observatory of Human Mobility	Indicators relating to universal access, efficiency and quality, safety, and clean mobility	IDB and CAF	Used to facilitate infrastructure investments within the region
Map of Greater Cairo's public transport network	Route data	TfC	Used to formulate transport master plans for the city
OSM Data on Dar es Salaam public transport services	Route data	Ally and the World Bank	Used to formulate transport master plans for the city
GTFS Data for Alexandria, Egypt	Route data	DT4A and TfC	Used to formulate transport master plans for the city
GTFS Data for Lusaka, Zambia	Route data	Sibusiso Ngoma	Can be used to improve current services and formulate transport master plans for the city
User-generated map of public transport services in Lusaka	Route data	Shaun Cleaver	Can be used to improve current services and formulate transport master plans for the city
Labor Informality in Paratransit Services	Labor networks	Tamara Kerzhner, Ph.D candidate at UC Berkeley	

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