Powering Mobility:
The rise of digital transportation in Africa

GSMA

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GSMA Digital Utilities

Utility services such as energy, water, sanitation, waste management and transport are essential to life. The Digital Utilities programme enables access to affordable, reliable, safe and sustainable urban utility services for low-income populations through digital solutions and innovative partnerships. In doing so, we also seek to support cities in low- and middle-income countries in their transition to a low carbon, climate-resilient future.

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Executive summary

Across the world, effective transport systems are integral to the growth and development of cities. However, in Africa, these systems face a few challenges which limit the cities' economic potential and lower the standards of living for their residents. For example, the poorest 20% of the population in African cities spend a significant proportion of their household income on transport services – more than other urban residents around the world, according to a World Bank study. Safety is also much of a concern as the continent bears the greatest burden of road accidents. Despite having only 3% of the world's vehicles, 20% of road fatalities happen in Africa. Pollution from vehicles is also having adverse effects on health and livelihoods, exacerbated by increased congestion. African cities are also expanding horizontally, complicating planning, and increasing logistical costs. These urban transport challenges dictate how city residents access work, education, health care and other essential services, all of which have a direct impact on standards of living and urban growth and productivity.

Digital solutions have a key role in ensuring transport services are affordable, effective, reliable and safe.

Technologies such as big data analytics, IoT, GIS tracking and mobile payments offer unique opportunities to tackle some of the challenges mentioned here. These solutions are also influencing the growth of innovative business models, which are being deployed across a range of use cases in African transport sectors. Some of the areas where digital solutions are gaining momentum include bus rapid transit (BRT) systems, e-mobility and platforms. Digital solutions are a key enabler of effective BRT systems, with seven cities having operational systems and nine of them about to or planning to deploy the system. The growth of the e-mobility ecosystem and the proliferation of digital platforms are also taking place at an opportune moment as the use of frontier technologies in transport gathers momentum. The expansion of mobile connectivity will also play a major role in accelerating the digitalisation of the transport sector.

Financing transport infrastructure and availing funding to innovations in the sector is key to promote digitalisation. Transport infrastructure heavily relies on governments, and there is a role for the private sector to play. According to our analysis, Sub-Saharan Africa has the lowest rate of private sector participation in transport investment at just 6%, compared to compared to 9% in Middle East and North Africa and 12% in Latin America. However, among start-ups, transport and logistics is the third most-funded sector, according to deals tracked since 2019. With start-ups attracting over $1.4 billion in the last four years, there are positive signals on where the market is headed.

The case studies in this report showcase some successful examples of organisations- AC Group digitalising payments in Kigali, GoMetro leveraging data for urban planning and Ampersand speeding up the electric vehicle transition- that have used digital solutions to change the dynamics of urban transportation.

Digital technologies in transport also provide opportunities for public-private collaboration, such as data-sharing partnerships, regulation and infrastructure planning and development. City officials, donors, enabling organisations and innovators working in the transport sector will need to collaborate to take advantage of the digital opportunity.

Funders and donors providing early-stage funding and supporting research are key to testing out new models. Enabling organisations also have a role in fostering partnerships across sectors. For governments, as regulation is struggling to keep pace in the rapidly changing sector, it is necessary to take a bottom-up approach but also integrate data in urban planning for evidence-based solutions. Mobile operators also have a role to play in ensuring that this data is available and by supporting transport innovators to integrate mobile solutions. For the innovators, key is to create solutions that bring value to all.

Digitalisation is set to continue expanding and adapting in African cities. There is a clear need to get ahead of the curve which means the public sector and enabling organisations need to pay careful attention to the digital ecosystems that are emerging. This report provides the foundation for understanding the landscape of innovation, and the companies and cities leading this transformation.

Advances in data, technology and digital innovation are rapidly transforming how essential urban services are operated and delivered, from energy and water to sanitation and waste management. As access to digital services expands around the world, traditional sectors are being disrupted and digital technologies and innovations are reconfiguring how societies function.

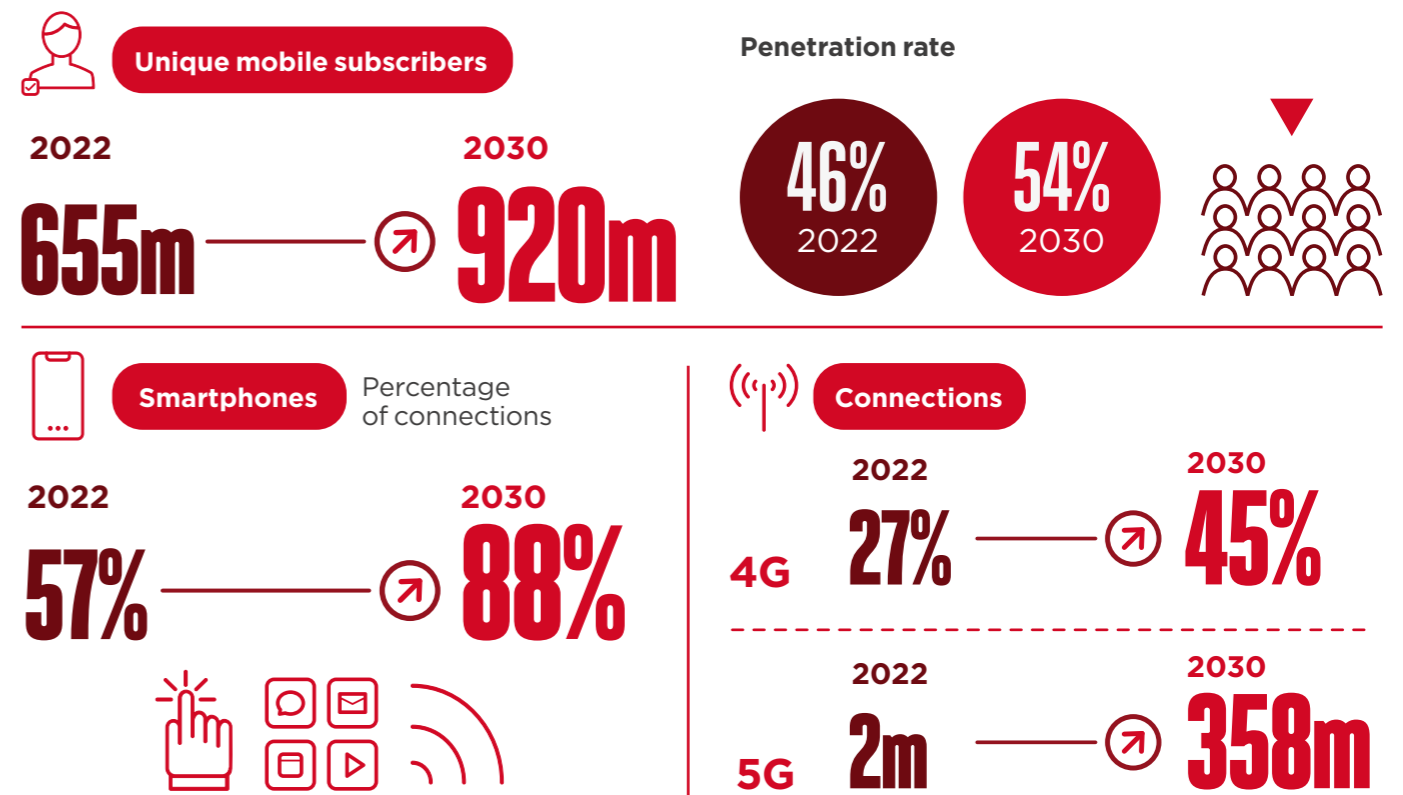**In cities, mobility drives urban development and provides a basis for better livelihoods**. The reliability, affordability and accessibility of mobility services dictate how urban residents access health facilities, job opportunities and engage with their city. In most African countries, as in other low- and middle-income countries (LMICs), there is often inadequate investment in public transport systems and infrastructure. This means residents have to cope with bad roads, high transport costs and congestion. The relationship between urban development and transport systems is both critical and complex; cities cannot reach their full economic potential without effective urban transport, making this an issue that cannot be ignored.[1]

Digital technologies can help forge a path to more efficient and inclusive transport services and, in turn, more inclusive cities. The expansion of mobile connectivity globally is enabling more sustainable solutions and accelerating digital transformation in the transport sector. In Africa, 655 million people are mobile subscribers – a 46% penetration rate that is expected to increase to about 54% by 2030. In addition, 40% of the continent's adult population are connected to mobile internet.[2] Tapping into the growth of Africa's mobile ecosystem to bolster digitalisation efforts will require different stakeholders coming together and adopting forward-looking policies and solutions.

Digital solutions have proven critical in addressing urban challenges that limit access to essential services and the economic and social mobility of residents.[3] These solutions, such as pay-as-you-go (PAYG)/pay-as-you-drive, big data, geographic information systems (GIS) and the Internet of

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1. Tsivanides, N., Lall, S. and Ngulube, M. (3 October 2022). "Creating Virtuous Circles between Urban Planning and Urban Transit". World Bank Blogs.
2. GSMA Intelligence
3. GSMA. (2020). *Digital Solutions for the Urban Poor.*

Figure 1
Overview of mobile expansion in Africa

Unique mobile subscribers

2022	2030
655m	**920m**

Penetration rate

46% 2022   **54%** 2030

Smartphones Percentage of connections

2022	2030
57%	**88%**

Connections

4G
2022	2030
27%	**45%**

5G
2022	2030
2m	**358m**

Source: GSMA Intelligence

1 Introduction

Things (IoT), have been applied across many use cases. We have observed their success in smart grids, off-grid solar, container-based sanitation, decentralised water points and asset tracking in waste management. In the transport sector, digital innovations have been widely adopted around the world, for example, to mitigate traffic flows, deploy charging infrastructure for electric mobility or real-time vehicle tracking and vehicle performance assessments. Despite the crucial roles of these solutions in improving mobility, digital innovations in the African transport sector are still nascent compared to the rest of the world. However, efforts to digitalise the transport system and disrupt existing models are ongoing.

Objectives and approach

This report aims to capture the landscape of the transport sector in African cities and the role of digital innovation in the sector. By leveraging digital technology and partnering with the mobile industry, cities and innovators can develop novel business models that make essential urban services more accessible. This research builds on insights from the previous GSMA reports work outlined in Box 1.

The broader objectives of this research are to:

— Highlight the role of digital solutions across transport modes and their influence on transport trends

— Present use cases for digital solutions in transport

— Examine the future role of digital in the transport sector, highlighting recommendations and actionable steps for the GSMA Digital Utilities programme and other stakeholders

Chapter 2 provides an overview of some of the challenges facing the transport sector in Africa. **In chapter 3**, we provide an overview of the opportunities of digitalisation, showcasing areas where digitalisation is prominent. We then analyse funding data to understand where the sector is headed. **In chapter 4**, we present three case studies to show successful examples of digitalisation. **To conclude**, we present recommendations to different stakeholders and offer our thoughts on what is next for the sector.

Box 1
Our past work in transport

As part of our market engagement activities, we have brought together start-ups, local government officials, regulators, enabling organisations and private sector partners at the Digital Utilities Urban Forums. In 2022, in collaboration with Utopia, we hosted a workshop in Lagos, Nigeria, that focused on driving government-innovator partnerships in the sustainable transport and waste management sectors. Workshop participants discussed some of the key challenges in the transport sector and the way forward.

Our research also builds on insights from earlier work to support innovation for digital urban services, which was published ahead of announcing the GSMA Innovation Fund for Digital Urban Services in 2021. Additionally, the research highlighted below contains insights relevant across transport use cases.

Digital Solutions for the Urban Poor (2020), highlighted how innovative technology can change urban transport systems, encourage social mobility and mitigate pollution. These solutions also help entrepreneurs scale and reduce operational expenses while reaching low-income communities.

Innovative Data for Urban Planning: The Opportunities and Challenges of Public-Private Data Partnerships (2021), highlights the growing role of data in urban planning solutions and the provision of urban utility services. Drawing on key use cases, our research found that public and private sector stakeholders both reap the benefits of data-sharing partnerships, as these help to bridge the data gap and enable governments to address urban development challenges with data-driven decisions.

IoT for Deployment: Use Cases Delivering Impact (2023) also identified common use cases in transport, detailing the use cases and key benefits that can be expected from IoT deployments. These use cases range from smart public transport and electric vehicles (EVs) to asset tracking and drones for delivery.
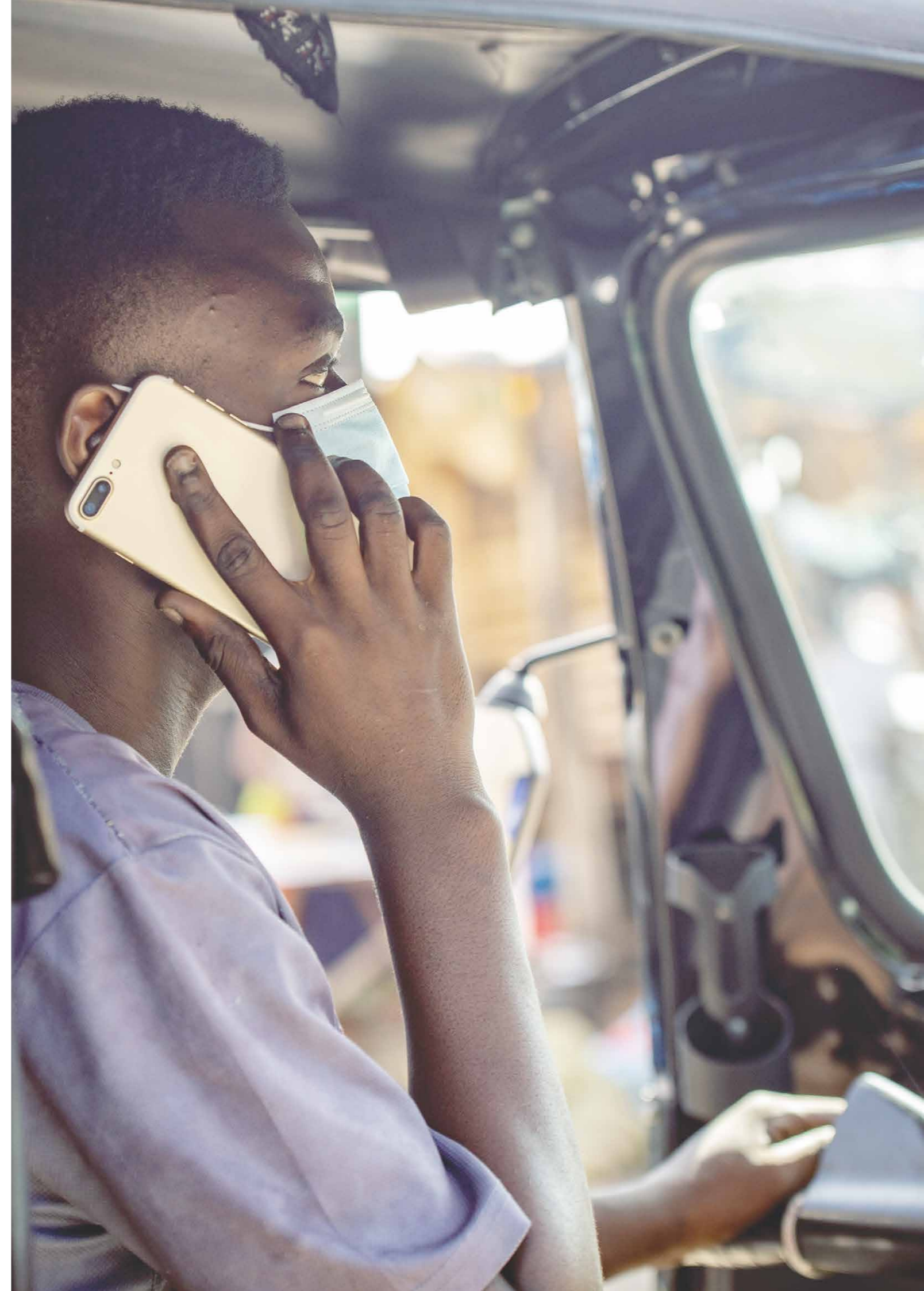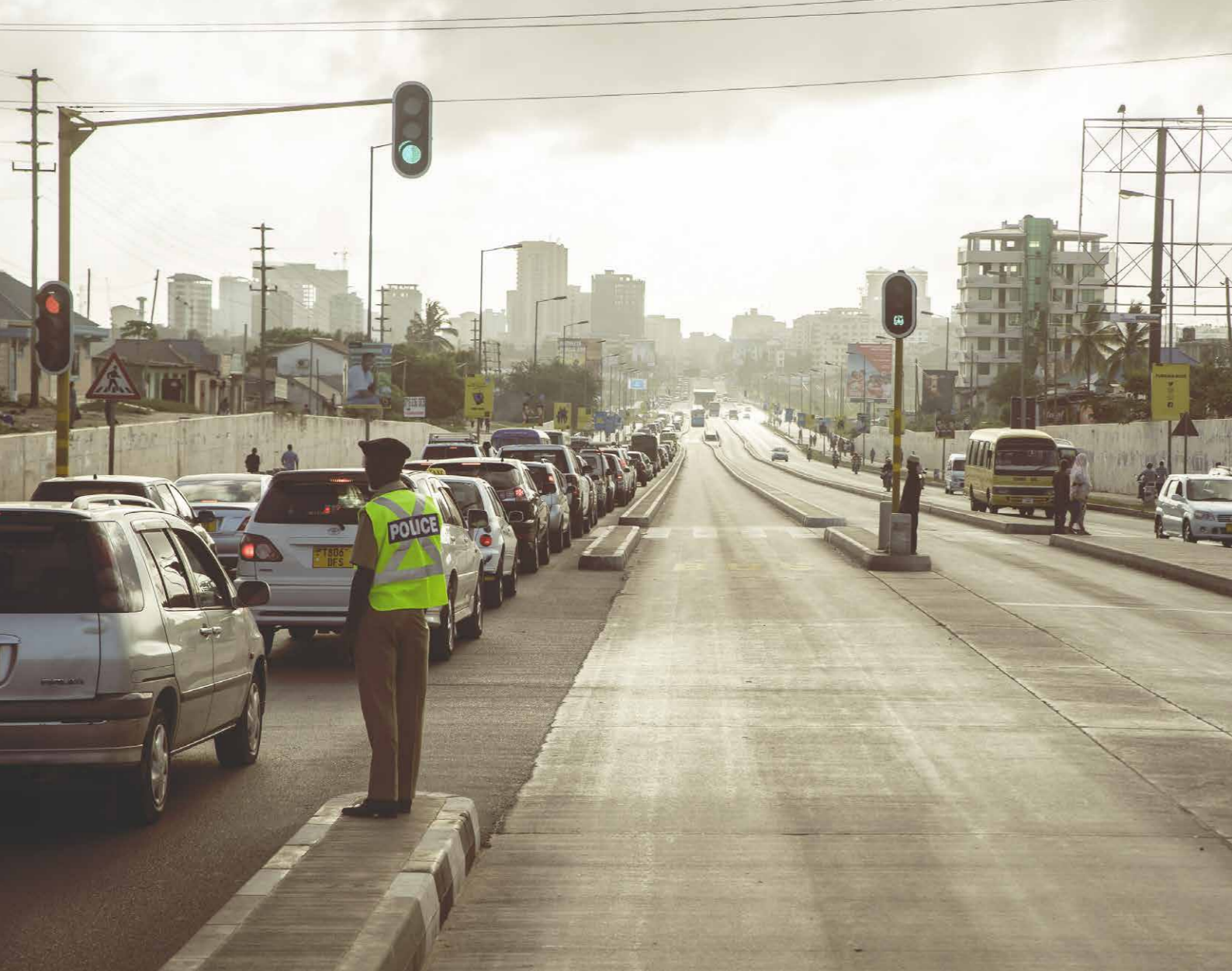
2 The challenges of Africa's urban transport systems

Today, 40% of Africa's population live in urban areas, and this is expected to increase to at least 60% by 2050.[4] This means an additional billion people – will be living in towns and cities in the next 30 years. However, rapid urbanisation in Africa is often not accompanied by structural transformation, which means that a significant proportion of urban growth is on city peripheries and in informal settlements. This is posing major challenges to municipal governments and service providers that struggle to provide access to reliable and affordable urban services, from energy and water to sanitation, waste management and transport, particularly for low-income populations.

This section provides a brief overview of transport in African cities and discusses five key challenges facing urban transport systems:

— Congestion

— Pollution from greenhouse gases (GHGs)

— High travel costs

— Lack of security and safety

— Urban sprawl

Historically, the development of urban centres in Africa was largely influenced by colonialism. Most capital cities began as small administrative centres for colonial rulers, and thereafter grew to accommodate the growing population moving from rural areas

to the city.[5] Post-independence, the competing priorities of city authorities minimised attention to mobility services. This has informed the political and socio-economic dynamics of transport in the region
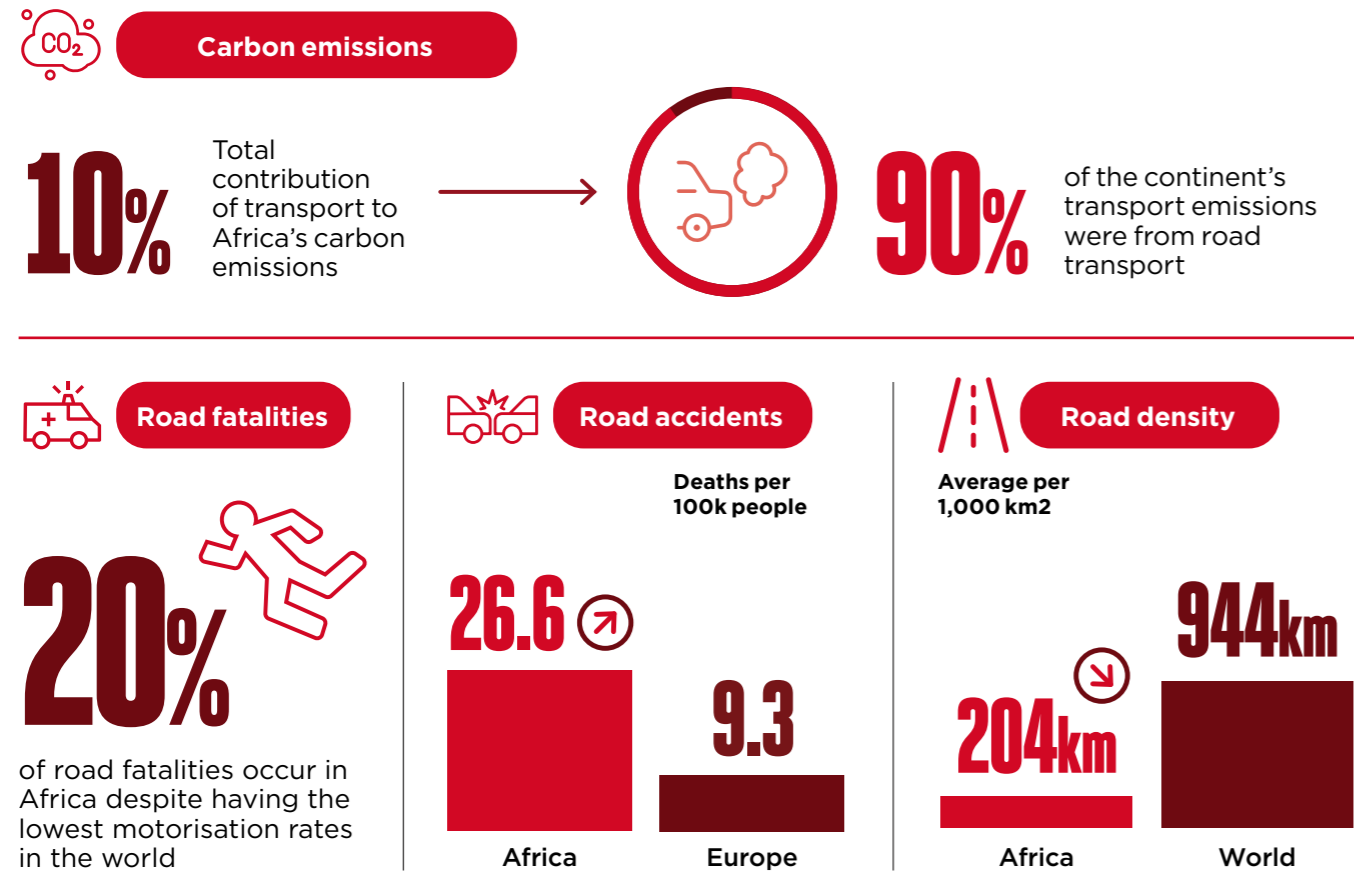
The inadequacy of public transport coupled with spatial and population growth gave rise to informal private transport operators, which are now the predominant mode of transport both within and outside cities, and are responsible for at least 70% of all transit rides in major African cities.[6] These private services, mainly vans and mini-buses, are now expanding to include motorbikes and three-wheeler vehicles. These modes of transport are similar across Africa, but most countries have their own identifiable forms of public transport with unique local names. For example, mini-buses and vans are commonly referred to as car rapides in Senegal, combis in South Africa, danfos in Nigeria, matatus in Kenya and trotros in Ghana, just to name a few. The lack of formal transport services exacerbates the challenges facing urban residents and economies. While they exist to fill the gap left by formal public transport operators, these services operated by private entrepreneurs are often self-regulated, making the quality and accessibility of these essential services contingent on operator choices and preferences.

4. Cities Alliance and African Development Bank. (2022). *The Dynamics of Systems of Secondary Cities in Africa*.
5. Behrens, R., McCormick, D. and Mfinanga, D. (2016). *Paratransit in African cities: Operations, Regulation and Reform.* Routledge.
6. Fried, T. and Abubaker, I. (27 May 2019). "In African Cities, Mapping Paratransit Makes for Smarter Mobility". *TheCityFix*.

Figure 2

High-level statistics on transport

Carbon emissions

10%
Total contribution of transport to Africa's carbon emissions

→

90%
of the continent's transport emissions were from road transport

Road fatalities

20%
of road fatalities occur in Africa despite having the lowest motorisation rates in the world

Road accidents

Deaths per 100k people

26.6 ↗
Africa

9.3
Europe

Road density

Average per 1,000 km2

204km ↓
Africa

944km
World

Source: **McKinsey and Company, WHO Africa, World Bank Group**

2.1 Pervasive congestion

Road congestion is a major issue in most African cities. Some of the causes of congestion are underdeveloped road networks, poor traffic management, weak enforcement of traffic rules and inadequate parking. While there has been progress in extending road networks, the density of roads in Africa lag compared to the rest of the world. According to the World Bank, the average road density on the continent is 204 kilometres (km) per 1,000 km², with only a quarter of this paved, while the world average is 944 km per 1,000 km².[7]

The challenge of congestion from low road density will only be exacerbated as populations grow, and as the lack of safe and quality public

transport has led to an increase in personalised motorised vehicles. Limited road infrastructure has also caused roads to deteriorate, and the lack of service lanes and pavement have contributed to this challenge. Where productivity is affected by time spent on the road, cities become less competitive. For example, in Nairobi, it is estimated that traffic jams cost the country's economy almost $1 billion in lost productivity every year.[8] In Lagos, residents spend an average of 30 hours a week in traffic.[9] Beyond the economic losses, the social impacts of congestion include increased travel time, higher travel costs, health risks, stress and fatigue.

7. World Bank. (2010). *Africa's infrastructure: A time for transformation*.
8. Ombok, E. (24 September 2019). "Traffic James in Kenya's Capital Bleed $1 Billion from Economy". *Bloomberg*.
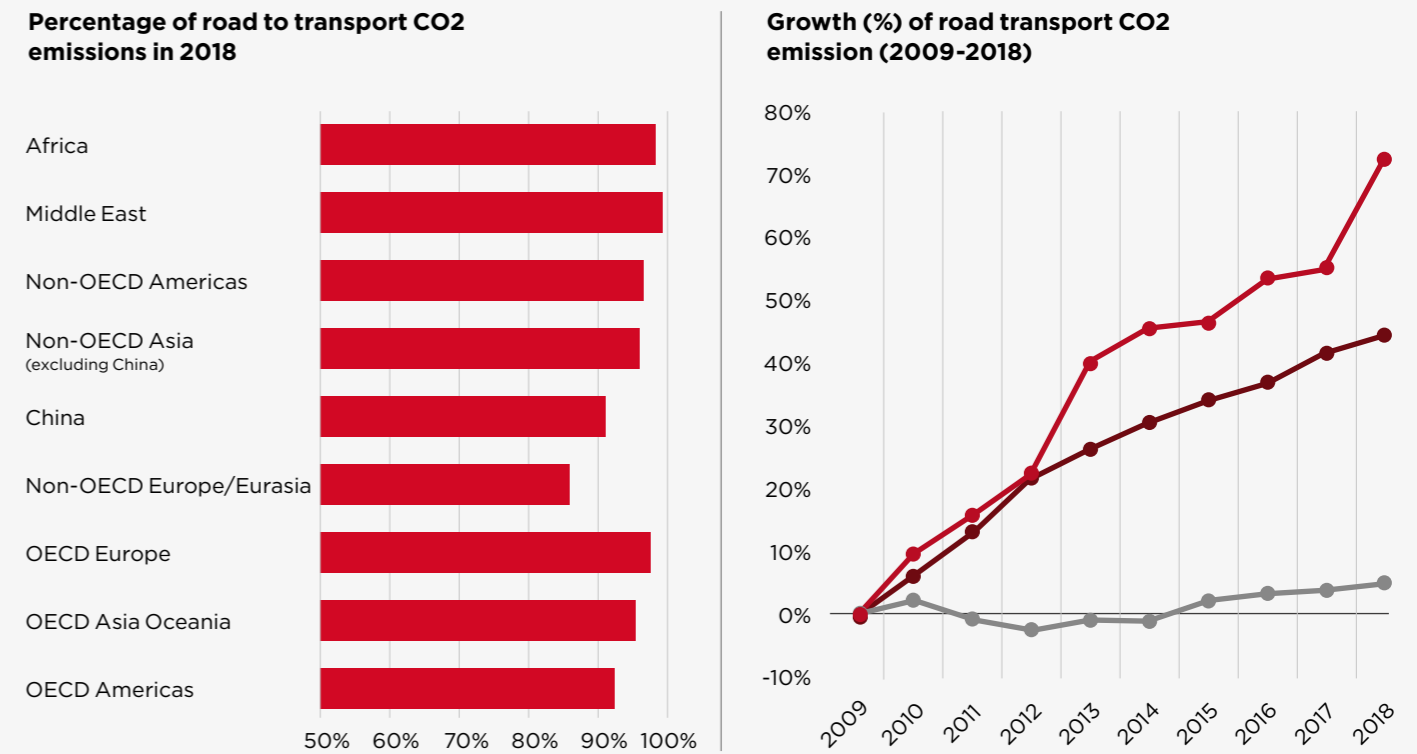9. Obi, D. (11 December 2018). "Lagos commuters lose 75% of weekly working hours to traffic". *Business Day*.

2.2 Pollution, air quality and GHG emissions

Transport currently accounts for 10% of Africa's total GHG emissions, and this is expected to increase over time.[10] In 2018, 90% of the continent's transport emissions were from road transport,[11] making the decarbonisation of road travel a clear priority. While Africa represents the smallest share of global GHG emissions at 3.8% – China accounts for 23% and the US for 19% – emissions have severe health effects and are likely to intensify as African cities expand and generate more economic activity.[12]

As road congestion increases, pollution from vehicles - and adverse effects on health and livelihoods - also rise. During traffic jams, GHG emissions from vehicles often double, increasing the risk of respiratory infections and premature death.[13] In 2018, air pollution caused an estimated 11,800 deaths in Lagos – 60% were children under five – while adults suffered from heart, lung and pulmonary diseases.[14] Transport emissions contributed the most GHGs, followed by industrial emissions and back-up generators. In Lagos, where traffic is ranked the worst in the world according to Numbeo's 2022 Traffic Index, tackling congestion is necessary to reduce emissions.[15]

10. McKinsey & Company. (2022). *Power to move: Accelerating the electric transport transition in sub-Saharan Africa*.
11. Benitez, D.A. et al. (2021). *Financing Low Carbon Transport Solutions in Developing Countries*. World Bank Group.
12. Dupoux, P. et al. (4 November 2022). "Africa's Opportunity in Digital Skills and Climate Analytics. Boston Consulting Group.
13. Opiyo, R. and Nzuve, L. (26 July 2021). "Daring to breathe: Why reducing traffic congestion in African cities is urgent". *SEI Africa*.
14. Kemper, K. and Chaudhuri, S. (3 September 2020). "Air pollution: A silent killer in Lagos". *World Bank Blogs*.
15. NUMBEO. (2023). "Current Traffic Index".

Figure 3

Percentage of CO2 emissions from transport across regions and over time

■ OECD
■ Non-OECD
■ SSA (24 countries)

Percentage of road to transport CO2 emissions in 2018

Region	
Africa	
Middle East	
Non-OECD Americas	
Non-OECD Asia (excluding China)	
China	
Non-OECD Europe/Eurasia	
OECD Europe	
OECD Asia Oceania	
OECD Americas	

(50% 60% 70% 80% 90% 100%)

Growth (%) of road transport CO2 emission (2009-2018)

(80%, 70%, 60%, 50%, 40%, 30%, 20%, 10%, 0%, -10% / 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018)

Source: **IEA, 2021**

2.3 High travel costs

Low-income residents who do not own their own means of transport bear the brunt of Africa's urban transport challenges. The cost of urban transportation as a share of household budgets is often high, especially for low-income earners. Reliable continent-wide data is not available but, in South Africa, workers are quitting their jobs as they cannot afford the high travel costs.[16] According to a survey conducted in Gauteng in 2019, nearly 60% of households spent more than the maximum policy target of 10% of income on transport.[17] In Addis Ababa, daily round trips by public transport for a month accounted for more than half of monthly expenditure for the poorest quintile.[18] Costs are also compounded by price fluctuations, which are largely at the whim of informal service providers who inflate fares during peak travel hours.[19] These prohibitive costs affect how most urban residents experience the city, as they curtail freedom of movement and limit access to employment opportunities, health care and other essential services.

High travel costs also have an impact on intra-city accessibility, which could lower productivity gains and the competitiveness of companies if average wages are raised to cover workers' transport

costs.[20] Land use is also affected as residents choose to live near where they work to avoid commuting costs, leading to the growth of informal settlements in city centres. Research has also shown that low-income residents are less likely to live near bus stops, forcing them to walk in areas that are not walkable, or take motorcycles, which are generally more expensive than public transport.[21,22]

Since most informal public transport is privately owned and operated, profits are often prioritised over the welfare of low-income urban populations, and drivers themselves can be put in precarious positions.[23] Vehicle owners usually hire drivers by the day expecting a fixed minimum

16. Ludidi, V. (16 July 2022). "South Africans quitting their jobs as they cannot afford travel costs". *IOL.*
17. CSIR. (22 October 2020). "Gauteng households spent 10% of their income on public transport – GHTS".
18. Africa Transport Policy Program. (2021). *African cities facing the urban mobility crisis.*
19. LagosUrbanNetwork. (12 January 2022). "Achieving Affordable Public Transport in Lagos and NMT". Lagos Urban Development Initiative.
20. Page, J. et al. (2020). *Urban Economic Growth in Africa.* Working Paper 24. Africa Growth Initiative at Brookings.
21. WRI. (2019). *Integrated Transport Opportunities in Africa: A Review of Nairobi and Kampala.*
22. The Conversation. (23 March 2021). "People living in African urban settings do a lot of walking: but their cities aren't walkable".
23. Kumar, A., Zimmerman, S. and Arroyo-Arroyo, F. (2021). *Myths and Realities of "Informal" Public Transport in Developing Countries: Approaches for Improving the Sector.* SSATP.

Figure 4
Transport costs in Africa compared to monthly household budget

Basic transport infrastructure in some African countries is so inefficient that it pushes up mobility costs to an extent where even the richest 20% spend more than half of their income on just getting around.

Percentage of income spent on food versus transport among the richest quintile

The unaffordable commute to work for the poorest in Africa's major cities.

- ■ Poorest quintile
- ■ Average household

Percentage of household budget needed for 2 trips/ day by minibus

CHAD 12% 73%
ETHIOPIA 11% 59%
GHANA 18% 45%
TANZANIA 10% 77%

Source: World Economic Forum (2015); The World Bank (2008). **Adapted from the GSMA**

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return, so high fares are set to meet this threshold.[24] For motorcycle riders, some rent from the owner for a daily or weekly fee, with profits based on the kind of agreement they have.[25] Some drivers are forced to work for more than 16 hours to barely make ends meet.[26] With recent increases in fuel prices, fares have also been rising steadily. Recently, taxi and buses in Uganda hiked their fares, citing increased cost of operations.[27] Kenyan matatus also adjusted their fares upwards by 20% for some routes as the cost of fuel made current fares unsustainable.[28]

2.4 Lack of safety and security

Both motorised and non-motorised transport in Africa tend to be unsafe and, at times, insecure. Infrastructure is poorly developed in cities, and although most urban trips involve walking, most cities do not prioritise sidewalks and pavement for pedestrians and cyclists.[29] Narrow roads, non-functioning traffic lights, lack of pedestrian bridges and zebra crossings, as well as poor road conditions, all make travel dangerous for both drivers and pedestrians. According to the World Health Organization (WHO), Africa accounts for 20% of global road fatalities despite only having 3% of the world's registered vehicles.[30] Moreover, the rates of road traffic deaths are highest in Africa at a rate of 26.6 per 100,000 people, nearly three times higher than in Europe.
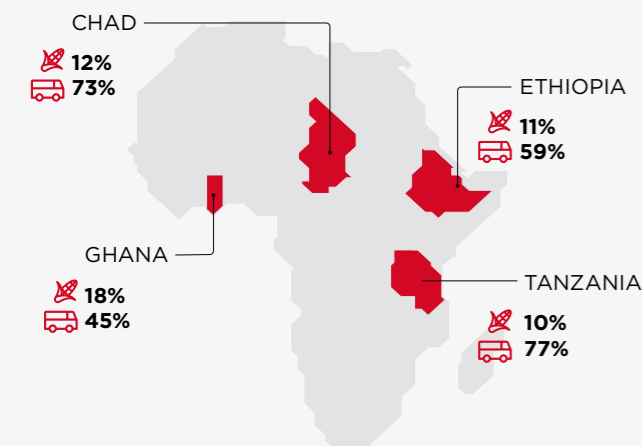
The situation is worse for those who use informal public transport means. Drivers have been reported to drive unsafely by overlapping and speeding as they try to make as many trips as they can. Besides having to meet a certain quota set by the owners, drivers are also usually extorted by police and government officials, depleting the money they earned that day.[31] Moreover, due to weak enforcement, most vehicles are not well maintained and pose a risk to both drivers and passengers.

The perceived and actual risk for women and girls is higher as they are likely to face gender-based violence and harassment during their trips (see Box 2).[32] Most routes lack designated pick-up and drop-off points, requiring passengers to wait in unsafe areas with poor lighting and a lack of transport workers.

24. Agbiboa, D. (12 April 2022). "'We Move': The Subversive Economy of Danfo". *The Republic.*
25. FIA Foundation. (2022). *The Wheels of Change.*
26. Jimoh, M.O. and van Zeijl, F. (16 November 2022). "All parents are having a hard time". Al Jazeera.
27. Katushabe, S. (22 April 2022). "Taxi operators hike fares over fuel prices". Monitor.
28. Kinyanjui, M. (20 June 2022). "Matatu fares to increase from today as PSV operators cite fuel cost hike". *Citizen Digital.*
29. Setty Pendakur, V. (2005). *Non-Motorized Transport in African Cities: Lessons from Experience in Kenya and Tanzania.* SSATP Working Paper No. 80. World Bank and SSATP.
30. WHO Africa. (21 November 2021). "Striving for safer roads in Senegal".
31. Agbiboa, D. (12 April 2022). "'We Move': The Subversive Economy of Danfo". *The Republic.*

Figure 5
Rates of road traffic deaths per 100,000 population by WHO region, 2013 and 2016

- ■ 2013
- ■ 2016

WHO Region

Region	2013	2016
Africa	26.1	26.6
South-East Asia	19.8	20.7
Eastern Mediterranean	17.9	18
Western Pacific	18	16.9
Americas	15.9	15.6
Europe	10.4	9.3
World	18.3	18.2

Rate of death/100m population

Source: WHO Africa

2.5 Expanding urban areas (sprawl)

Many African cities have developed rapidly as sprawling small villages and fragmented neighbourhoods combine into one urban area. Most spatial urban growth occurs horizontally through expansion of the urban boundary rather than through increased density. Metropolitan areas in Sub-Saharan Africa have low-density populations compared to urban areas of similar size in other LMICs. Growth is taking place in the peripheries, beyond established city boundaries. For example, the Accra Metropolitan area's population doubled between 1985 to 2000, but the geographical area itself expanded by 160%.[33] Relative to its population, Accra gained fewer inhabitants than surrounding municipalities with the average population density across the region declined by about 40%.

Sprawl affects major modes of transport both within and outside city limits, with smaller capacity vehicles used to travel beyond the city whereas larger buses move within the city. This has increased logistical costs and limited job opportunities for workers living outside the city centre. Dispersed growth and inadequate roadway infrastructure make it difficult for conventional, fixed-route public transport to serve the public. Because the poor have few financial resources and little political power, they are disproportionately affected and often excluded from work, education, health care and other essential services.[34]

Sprawl has also led to urbanised areas straddling different local authorities and municipalities, causing authorities to have fragmented responsibilities across each jurisdiction and complicating planning. For example, national highway agencies, rural agencies and city roads authorities might be in conflict about who is responsible for regulating what. There is therefore a need for coordination and clear allocation of responsibilities among the public sectors.[35]

Box 2
Women's experiences using public transport

Safety on public transportation is an issue that disproportionately affects women and girls. Globally, three out of five women have reported experiencing sexual harassment on public transport. It is estimated that, after public streets, public transportation is the second most common place for women to be sexually harassed.[36] It has been shown that women often have complex travel patterns, combining trips from work to the market for food, to picking up children from school, all before heading home. Women are more likely to make more total trips in a day than men, who tend to make linear trips. Women are also less likely to have access to private transportation, which increases their chances of using public transport. Women may opt to walk more due to the victimisation and harassment they experience on these trips.

Harassment takes different forms, from physical to verbal and non-verbal, and can cause women psychological trauma while also limiting their mobility and right to movement and access to public spaces. There is therefore a need to address the issue and provide solutions that will enable women and girls to move around safely.

32. IFC. (2020). *Addressing Gender-Based Violence and Harassment (GBVH) in the Public Transport Sector*.
33. World Bank (2017). *Implementation Completion and Results Report*.
34. UN Habitat. (2008). *The State of African Cities: A Framework for Addressing Urban Challenges in Africa*.
35. Njoroge, B. (14 December 2021). "Enabling Government-Innovator partnerhips in Lagos: Insights from our workshop". *GSMA Mobile for Development Blog*.
36. USAID. (2020). *Gender-Based Violence on Public Transportation: A Review of Evidence and Existing Solutions*.

3

Digital transport solutions in Africa

In this chapter, we explore some of the digital solutions in the transport sector, showcasing relevant digital innovations and their use cases in the context of common transport modes. We also explore funding and financing trends in the sector, identifying key trends in start-up funding on the continent.

Mobility services on the continent range from cargo to passenger transportation, with some transport systems offering both services. While this report focuses on public passenger transport, it is important to understand other available modes of transport for context. Cargo transportation is mainly categorised by freight – ground, ocean or air – depending on the size, distance and urgency of the goods being transported. Ground freight ranges from rail to trucks and vans to motorcycles for quick and short deliveries.

Categorising passenger transportation is somewhat complex due to the overlaps between different modes. Recognising the changing nature of urban mobility, this report uses an expanded version of the traditional definition of public and private transport. For public motorised transportation, we categorise those "that operate at regular times on fixed routes." We also consider the shared use of private vehicles, such as mini-buses and vans, and categorise them under paratransit.

3.1 Digitalisation in transport

The expansion of mobile connectivity has enabled the rise of digital solutions, which are playing an increasingly important role in making transport accessible and efficient. As mentioned earlier, the number of unique mobile subscribers in Africa has been rising and is expected to reach 54% by 2030.[37] Over the past five years, mobile internet connectivity has also improved, with connected users in Sub-Saharan Africa increasing from 17% to 22%.[38] Unsurprisingly, internet use is higher in urban areas than rural areas, and the gap is wide with 50% of urban residents online compared to just 15% of rural dwellers.[39] These trends will allow many organisations to provide digital solutions to African residents. Digital solutions such as big data analytics, IoT, GIS tracking and mobile payments offer unique opportunities to tackle some of the challenges mentioned here. These solutions ensure that transport services are affordable, effective, reliable and safe for users. They also act as a bridge to the formalisation of informal services.[40]

Technology supports more inclusive transport as it can be used to overcome barriers to inclusion. The rise of mobile connectivity has not only introduced new data sources for evidence-based policymaking that can reach marginalised low-income urban residents, but also enabled the proliferation of market-creating innovations that make products and services more accessible to all.[41]

37. GSMA Intelligence. (2022). *The Mobile Economy: Sub-Saharan Africa*.
38. GSMA. (2022). *State of Mobile Internet Connectivity 2022*.
39. ITU. (2021). *Internet use in urban and rural areas*.
40. Center for Global Development. (2018). *Let's Be Real: The Informal Sector and the Gig Economy are the Future, and the Present, of Work in Africa*.
41. Bauer, G.K. (6 June 2019). "Oxford Business & Poverty Conference: Why market-creating innovations are critical in the fight against poverty". *GSMA Mobile for Development Blog*.

Figure 6
Motorised transport modes
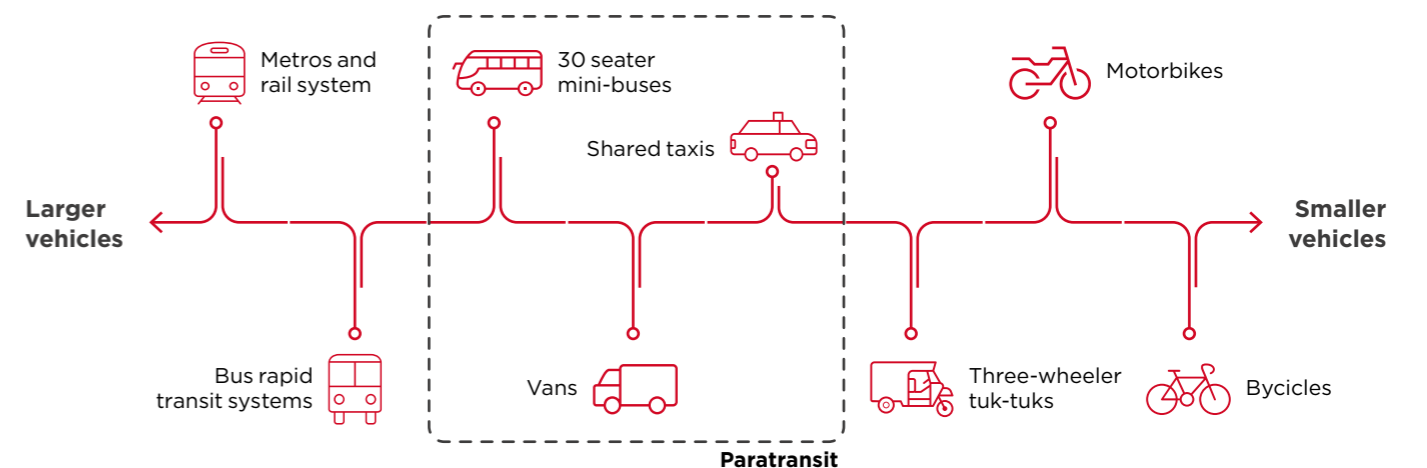
Adapted from the Volvo Research and Educational Foundations **(2020)**

3.2 Key use cases where digital is shaping the mobility sector

As the transport sector continues to digatalise, digital solutions are being used extensively for certain use cases. Digital innovation is gaining momentum in bus rapid transit (BRT) systems, electric vehicles and ride hailing, to name a few. These use cases impact how urban residents experience transport and will play a major role in shaping urban mobility in the future.

Bus rapid transit systems

Many cities in the world are searching for ways to address their urban transportation challenges, and viable alternatives have emerged in recent years, including BRT systems. A BRT system integrates flexibility and low-cost features, and is more modern and technologically advanced than mini-bus taxis and vans.

Africa's first BRT system started in 2008 in Lagos, Nigeria,[42] **and has since expanded to seven on the continent**. Three African cities launched BRT systems in 2016: Marrakech, Accra and Dar es Salaam. For Dar es Salaam, this meant that the metropolitan area of more than 4 million people had its first formal public transport system. This project has been lauded as quite successful, with travel times cut by almost half.[43] As of 2021, 17 cities had implemented a BRT system or were planning to implement one.

42. Mobereola, D. (2009). *Lagos Bus Rapid Transit: Africa's first BRT scheme*. SSATP Discussion Paper No. 9. SSATP.
43. Shauri, J. and Mimano, C. (11 February 2022). "Optimising BRT operations in Dar es Salaam". *Transport Journal. ITDP Africa.*

Figure 7

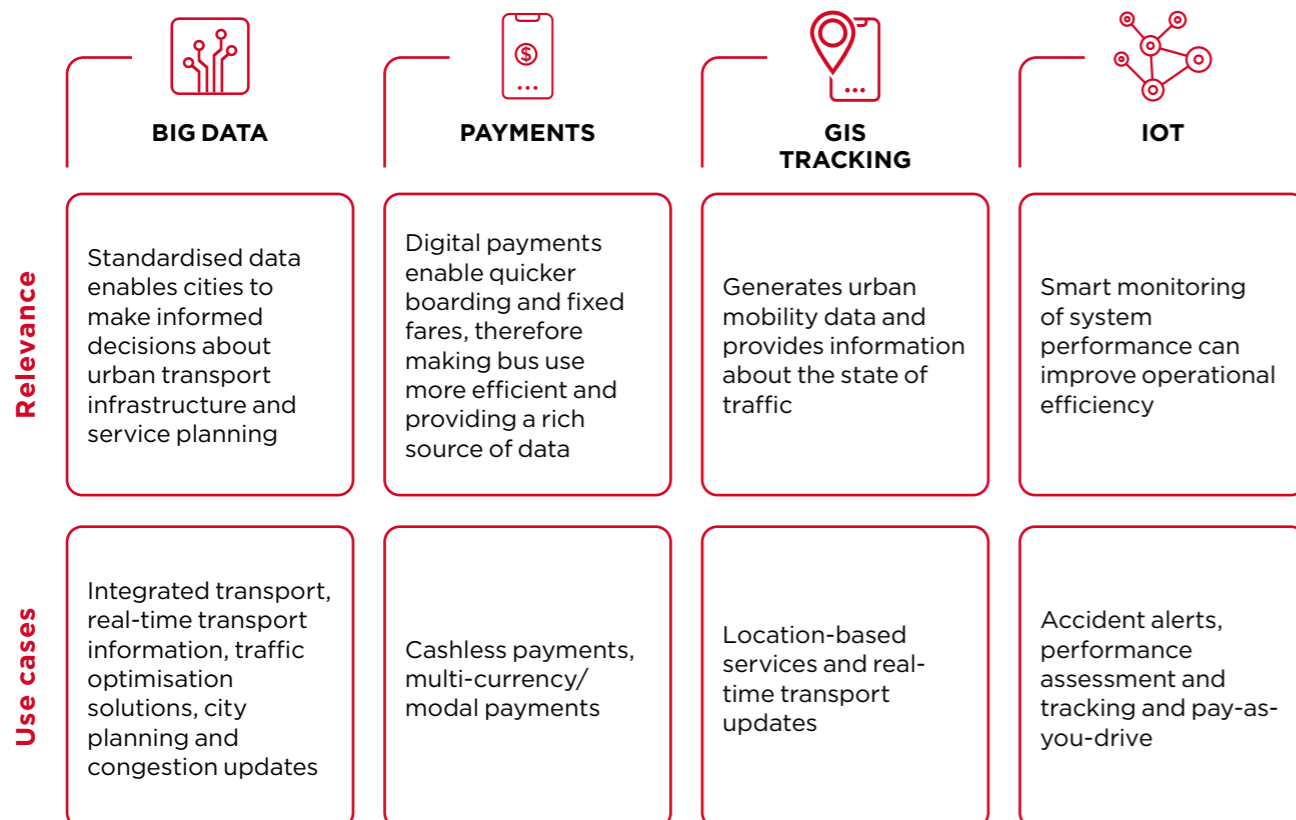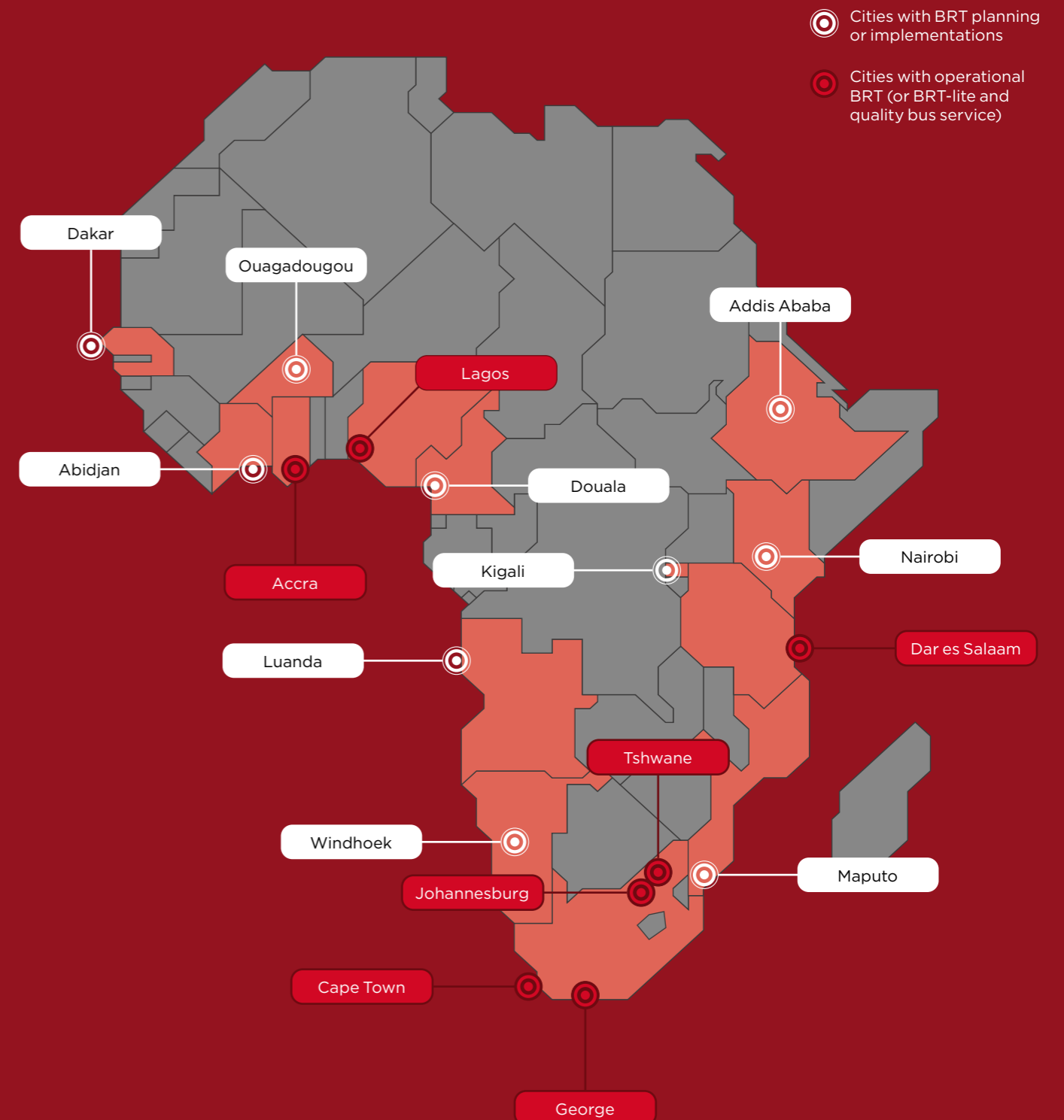## How digital solutions are relevant in the transport sector

	BIG DATA	PAYMENTS	GIS TRACKING	IOT
Relevance	Standardised data enables cities to make informed decisions about urban transport infrastructure and service planning	Digital payments enable quicker boarding and fixed fares, therefore making bus use more efficient and providing a rich source of data	Generates urban mobility data and provides information about the state of traffic	Smart monitoring of system performance can improve operational efficiency
Use cases	Integrated transport, real-time transport information, traffic optimisation solutions, city planning and congestion updates	Cashless payments, multi-currency/ modal payments	Location-based services and real-time transport updates	Accident alerts, performance assessment and tracking and pay-as-you-drive

Figure 8

Cities with operational and planned BRT systems

Cities with BRT planning or implementations

Cities with operational BRT (or BRT-lite and quality bus service)

Dakar · Ouagadougou · Addis Ababa · Abidjan · Lagos · Douala · Kigali · Nairobi · Accra · Luanda · Dar es Salaam · Tshwane · Windhoek · Johannesburg · Maputo · Cape Town · George

Source: World Bank

Digital solutions have been key in planning new routes for BRTs through GIS tracking and anonymous mobile data. For example, using a real-time data stream of mobile data network that is converted into statistical indicators, mobility patterns can be easily identified. Data is collected through localised mobile data from customers on a specific network, which is then aggregated and anonymised and, finally, fine-tuned and extrapolated to the total population. Other data that can be used include app-enabled GPS data, Wi-Fi logs and IoT-generated data.

Flux Vision, a data analytics solution by Orange, was used to map travel patterns in Dakar, Senegal.[44] Using call detail records (CDRs), the project determined day-to-day volumes of trips, traveller profiles, origin-destination flow and changes in trip patterns due to external events, such as construction work along a route.

Some BRT systems, such as those in Tanzania and Lagos, have adopted an integrated digital payment system that leverages the use of mobile money and point of sale machines for card payments. Real-time customer information can be gathered to determine frequently-used routes and priority stops. Digital payments also make it flexible and hassle-free for commuters and allows fares to be standardised. For transport authorities, automated transactions enable accountability in revenue management and tax payments. Automated vehicle tracking will also improve operational efficiency, minimising wait times for users and allowing authorities to keep track of how buses are used.

The Dar es Salaam Rapid Transit Agency (DART) is planning to enforce digital payments and tracking services, which will enable it to shift to a gross cost contracting model. This will allow drivers to be paid by the number of kilometres driven and an independent fare collection company can oversee payments.

There are several benefits that accrue from implementing the BRT systems in cities. Both the capital costs of building and implementing BRT and the operational costs are attractive and generally lower than light rail or metro systems. BRT has all the features of rail rapid transit, including its own right of way (typically on bus lanes, segregated from other traffic), good-quality vehicles, short waiting times and stations with off-board fare collection. These features enable smooth and fast operation of the BRT service. BRT also has better key performance indicators (KPIs), such as passenger travel times and passenger capacity per hour, than conventional buses operating in mixed traffic.[45] There is also a positive economic impact on the city due to shorter commuting times[46] – the number of jobs accessible to urban residents, especially those from low-income communities, significantly increases.

BRT systems have faced criticism when compared to the benefits of rail systems, and their failure to shift mobility behaviour from private cars to public transport. Due to the size of the vehicles, buses tend to be overcrowded during peak hours.[47] Full integration across payments and ticketing and travel information have yet to be implemented across most cities, limiting the efficiency of the systems. However, the initial cost of building a rail system is quite high compared to BRT systems.

Electric mobility

Many LMICs are grappling with the adverse effects of climate change. Globally, the transport sector is the third largest contributor to GHGs according to a report by the Intergovernmental Panel on Climate Change.[48] However, in LMICs, this number is lower. For example, Africa contributed only 3.8% of global CO_2 emissions, with 10% coming from transport. While this is miniscule compared to emissions from high-income countries, these numbers will continue to rise. Therefore, reducing transport-related carbon emissions is at the core of most countries'

climate mitigation and public health strategies. To accelerate the move to lower emissions while also taking into account the growing populations that need to be mobile, cleaner transport methods will be needed. The focus to transition to clean energy, coupled with the surging fuel costs, has spurred the growth of electric vehicles (EVs) on the continent.

Some governments in Africa have started to announce electrification targets for vehicles and incentives for EV adoption. For example, Rwanda has announced tax exemptions for EV sales and Kenya is pushing for EVs through climate-friendly policies.[49,50] The start-up ecosystem for EVs, particularly electric two-wheelers, is emerging in Africa, but the continent faces unique challenges with the transition to electric vehicles, including, in some cases, an unreliable electricity supply, unaffordable vehicles and the predominance of used vehicles.

Numerous initiatives have sprung up across the continent to promote localised vehicle electrification. In Egypt, the government plans to establish a nationwide charging network as the local electric vehicle industry makes strides,[51] and hope to produce local electric cars that will hit the market soon. In Uganda, state-owned vehicle manufacturer Kiira Motors Corporation has launched locally manufactured electric buses, while Zembo is assembling and selling electric motorcycles on a PAYG model. Meanwhile, in Kenya, the voluntary work and educational programme, National Youth Society, has supported the development of electric three-wheelers and carts for ferrying goods over short distances.[52] Kenya Power and Lighting Company has also announced plans to build charging points countrywide to support the import of electric cars. They are also proposing a special tariff for electric vehicle charging for the next five years to incentivise investment in the e-mobility sector.[53] With plans to expand to other African countries, Rwandan electric motorcycle company Ampersand has introduced a new fleet of electric motorcycle taxis.

Kenyan electric bus start-up Basi-Go is set to roll out their first fleet of buses after a successful four-month pilot. The company has announced plans to introduce 100 electric buses by 2023, with a goal of hitting 1,000 by 2030.

BasiGo, which locally assembles buses produced by Chinese company Build Your Dreams (BYD) Automotive, has so far raised several rounds of funding and is partnering with local banks to offer flexible financing options. They operate a pay-as-you-drive model that allows operators to subscribe to a $0.17 per kilometre fee, giving them access to a leased battery, charging services and maintenance.

The company also has a smart bus locator that uses GPS data to track buses in real time to reduce wait times for passengers at bus stops.

BasiGo will soon be launching a platform that will provide owners with real-time monitoring of bus location and performance, operational insights and customisable reports on their electric bus.

44. Orange Business. (n.d.). "Flux Vision: improve your customer knowledge".
45. Maunganidze, L. and del Mistro, R. (2012). "The Role of Bus Rapid Transit in Improving Public Transport Levels of Service, Particularly for the Urban Poor Users of Public Transport: A Case of Cape Town, South Africa". Abstracts of the 31st Southern Africa Transport Conference (SATC 2012).
46. Tsivanides, N., Lall, S. and Ngulube, M. (3 October 2022). "Creating Virtuous Circles between Urban Planning and Urban Transit". World Bank Blogs.
47. Andrew, L. et al. (2022). "Operational evaluation of the bus rapid transit system: Case study of Dar es Salaam city". Journal of Public Transportation, Volume 24.
48. Intergovernmental Panel on Climate Change. (2022). Mitigation of Climate Change: Summary for Policymakers.

49. Mininfra. (27 April 2021). "Rwanda has awesome new incentives for electric vehicles".
50. Tuvuti. (20 January 2023). "Kenya Accelerates Adoption of Electric Vehicles with Rollout of Charging Infrastructure and Financial Incentives".
51. Wirtschafter, J. (22 December 2022). "Turkey, Saudi Arabia, Egypt Building Factories for Battery Powered Vehicles". VOA.
52. Maina, S. (13 April 2021). "All You Need to Know About Kenya's First Electric TukTuk and Mkokoteni". Gadgets Africa.
53. Kuhudzai, R.J. (12 February 2023). "Kenya Power's E-Mobility Conference Develops Roadmap for Electric Motorization".

Digital payments can unlock EV usage as interoperability across different transport modes helps to maximize transport connectivity. EV users can use PAYG when paying for the initial purchase. With the convergence of other innovations, such as IoT and cloud services, PAYG will allow the update and control of assets through machine-to-machine (M2M) communication and enable communication between service providers, customers and local sales agents. Currently, off-grid solar providers such as Bboxx and M-KOPA are redeploying their expertise to asset financing of e-mobility, an indication that users may be able to access EVs more affordably. Bboxx has partnered with Ampersand to finance thousands of motorcycles for local riders, while M-KOPA has partnered with Roam (formerly Opibus) to lower the barrier to entry for electric motorcycle customers in Kenya.[54,55]

For battery charging, IoT devices (cellular and non-cellular), cloud software and data analytics play a critical role in increasing EV adoption. These technologies can help monitor the level of charge and battery health, alerting both the user and provider in time and preventing issues arising from battery malfunction. They would also allow for remote diagnostics to deliver a seamless user experience.

Energy companies such as Karaa and Mobile Power that intend to enter the business of EV charging will also have to leverage digital solutions that support operational capabilities, such as monitoring charging points and charger supply chain management. For energy provision, shifting to smart meters to monitor energy use in near-real time can cut costs and help to balance supply and demand. For mini-grid operators, smart meters will help to make decisions that will increase usage and reliability.

The addressable market for two-wheeler EVs in Africa is quite large with an estimated 27 million motorcycles, and this number is expected to reach 55 million by 2030.[56] Innovators such as Ampersand, Gozem, Roam, Ecobodaa and Zembo will be invaluable in helping riders save on transport costs, making two-wheeler transportation affordable and reducing carbon emissions.

As urbanisation and incomes rise across Africa, so does the demand for vehicles. The number of registered vehicles on the continent is expected to move from 25 million vehicles today to an estimated 58 million by 2040.[57] A challenge for Africa, therefore, is to avoid becoming a dumping ground for used internal combustion engine vehicles from high-income countries as larger automotive markets swap them out in favour of EVs.

To move towards a sustainable energy future, African countries will need to focus on improving energy access and reliability, particularly clean energy, and implementing policies to promote the development of charging infrastructure. This will need to be built ahead of projected demand and ensuring partnerships with various players in the private sector to accelerate the energy transition. EV companies already operating in Africa have scope to invest in local innovation for the domestic manufacturing of EV components, such as spare batteries, to enable local vehicle assemblers to source parts locally.

The "platformisation" of transport

As digitalisation increases, platforms are becoming increasingly popular in most sectors. Platforms are usually defined as technology-enabled business models that create value by facilitating exchanges between two or more interdependent groups.[58] The transport sector is synonymous with the platformisation of economies, with companies such as Über and Bolt being early pioneers. Technological advancements such as IoT, sensor networks and M2M communication are at the forefront of advancing this phenomenon.

54. Bboxx. (12 October 2022). "Bboxx partners with Ampersand to provide thousands of taxi e-motos for drivers in Rwanda".
55. Roam. (17 October 2022). "Roam and M-KOPA sign first major supply agreement for deployment of electric vehicles in Africa".
56. FiA Foundation. (16 November 2022). "The Wheels of Change: Safe and Sustainable Motorcycles in Sub-Saharan Africa".
57. Conzade, J. et al. (23 February 2022). "Power to move: accelerating the electric transport transition in sub-Saharan Africa". McKinsey & Company.
58. Joiner, J. and Hinrichsen, S. (2021). Scaling digital platforms through partnerships: The value of collaboration between mobile operators and digital platforms in emerging economies. GSMA.

Besides this frontier technologies, the rise of digital payment ecosystems, smartphone ownership, youthful populations and venture capital funding, are all influencing the emergence of these services.

Platforms hold multiple sources of value as shown in Figure 10. For example, a potential source of value is the network effect where the value increases with the number of users.[59] Ride-hailing apps such as Gojek and SafeBoda collect billions of GPS data points that can be used to map traffic patterns. Another source of value from platforms is derived from the efficiency they afford. Platforms facilitate more efficient exchanges between buyers and sellers since prices are revealed upfront, and ratings and review systems are incorporated in the platform.

The platform market is already disrupting the transport sector through formalisation, such as the taxi industry and paratransit services (through ride-sharing platforms). The ride-hailing and ride-sharing sector provide the potential to formalise

employment, improve working conditions and rationalise transport routes for drivers. It has also led to gender mainstreaming in industries such as motorcycle taxis, offering women the opportunity to work in the sector.[60] They have also enabled drivers to adhere to certain safety and security standards while offering them a range of benefits, such as insurance and training.

For the end customer, these platforms now offer more than just ride-hailing by leveraging distribution networks and the dynamism of the informal sector to offer value-added services. Super apps such as Gozem, temtem One, Careem and Little allow users to make cashless transactions, order delivery services and book a ride. These cashless transactions, which include mobile

59. White, Z. (20 April 2022). Digital platforms for utility services- emerging trends and what might come next. GSMA Mobile for Development Blog.
60. Gachoka, A. and Winiecki, J. (2020). Assessing the impact of tech-enabled urban mobility. Shell Foundation and BFA Global.

Figure 9

Key enablers of digital platforms
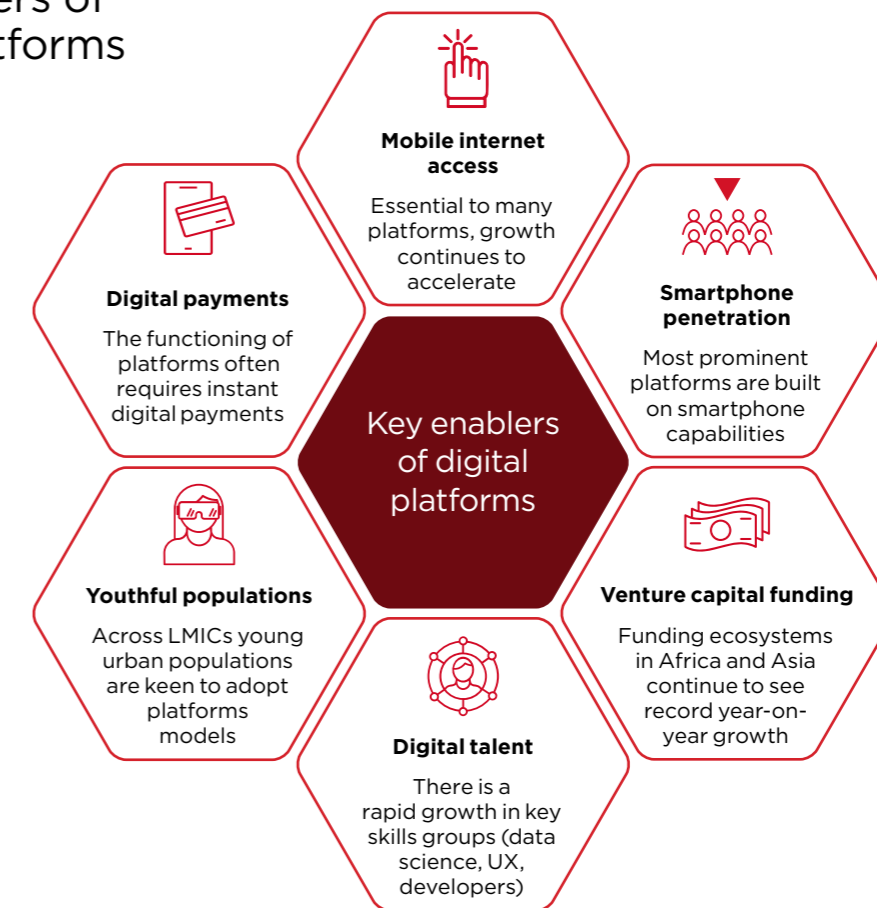
Source: GSMA (2021)

Figure 10

Potential sources of value of digital platforms

1 **Trust:** rating, verification and review systems or other safety features

2 **Traceability and open ledgers:** value generated simply by transparently recording exchanges

3 **Revealed prices:** the act of many buyers and sellers using the platform means prices are revealed

Potential sources of value

4 **Network effects:** value increases with the number of users

5 **Removals of barriers to entry:** platform disrupts closed-shops markets

6 **Market creation:** the platform creates the possibility for trade where none existed

7 **Efficiency:** the platform facilitates more efficient exchange between parties

Source: GSMA (2021)

Spotlight 2
SafeBoda

SafeBoda, a Ugandan super app that operates in Kampala, Uganda, has grown tremendously from being a ride-hailing app for motorcycles to offering more services, such as food delivery services, airtime purchase, cashless payments, mobile money transactions and a savings scheme that offers 7% annual interest.[61] SafeBoda has also recently launched a SafeCar option allowing users to hail taxis. With the tagline "Africa's Super App", the app is now a force in both the transport and fintech sectors.

SafeBoda has helped improve the transport sector in Kampala by giving users the opportunity to increase road and personal safety through the provision of safety lessons, helmets and reflector jackets. Riders have earned more credibility by being onboarded onto the platform and have the chance to earn more. Having onboarded thousands of boda riders, there is also the opportunity to provide key city data needed to plan or support trials of new business models. In 2020, Zembo partnered with SafeBoda to offer some of their riders the opportunity to test out their e-bikes and battery swapping stations.

SafeBoda has also improved the livelihoods of their riders, helping them to earn at least 25% more when repaying their loans and 50% more once they own their motorcycles.

payments, expand the addressable market to cover unbanked low-income populations. This can be a valuable source of data and can be optimised to complement data from the city data platform.[62,63] Mobile payments are also made in real time, reducing the settlement gap between payment and processing, which can be help providers improve efficiencies and financial transparency. With the increase in connectivity across the continent and adoption of smartphones, this will be a game changer.[64]

In the transport and logistics sector, platforms have certain drawbacks. Some market players gain excessive power, and there are risks associated with the causalisation of work and the proliferation of the gig economy.[65]

61. See: https://www.safeboda.com/
62. Arroyo Arroyo, F. and Nina, K. (29 June 2021). "Transforming public transport in Africa: Are automated fare systems the answer?". *World Bank Blogs*.
63. AfricaNenda. (October 2021). *The State of Instant Payments in Africa: Progress and Prospects*.
64. GSMA. (2021). *The State of Mobile Internet Connectivity 2021*.
65. Rest of World. (21 September 2021). "Gig workers are uncertain, scared, and barely scraping by".

Box 5
Opportunities provided by digital platform solutions

Platforms leverage a range of digital solutions to function properly, from smart data solutions to IoT to mobile payments. Data generated from digital platforms rely on cloud computing to store and manage their data and applications, while big data analytics is required to process this large volume of data. With the assistance of artificial intelligence (AI) and machine learning, personalisation is also made possible, improving user experience on the app.

IoT and GIS tracking are key in platforms that offer delivery services as they allow users to track their packages throughout the course of delivery. These solutions are also integrated in ride-sharing apps as they enable oversight of drivers in real time, generating data that can track the vehicle's location as well as driving behaviour, such as speed, enhancing both driver and rider safety. The GPS and IoT systems also improve travel efficiency as trips are allocated based on proximity and route information, updated to avoid traffic incidents.

There are also unique instances in which mobile operators have played a direct role in ensuring these platforms reach a wider market. In Kenya, taxi-hailing service Little partnered with Safaricom, a local mobile operator, to allow customers to request for a ride through a USSD code.[66] Those who were previously locked out of these services because they did not own a smartphone can now access Little.

Mobile technology and IoT are both critical components of the digital platform ecosystem, enabling platforms to deliver more personalised and integrated experiences to users, while also unlocking new opportunities for innovation and efficiency.

3.3 Funding and Financing trends in transport
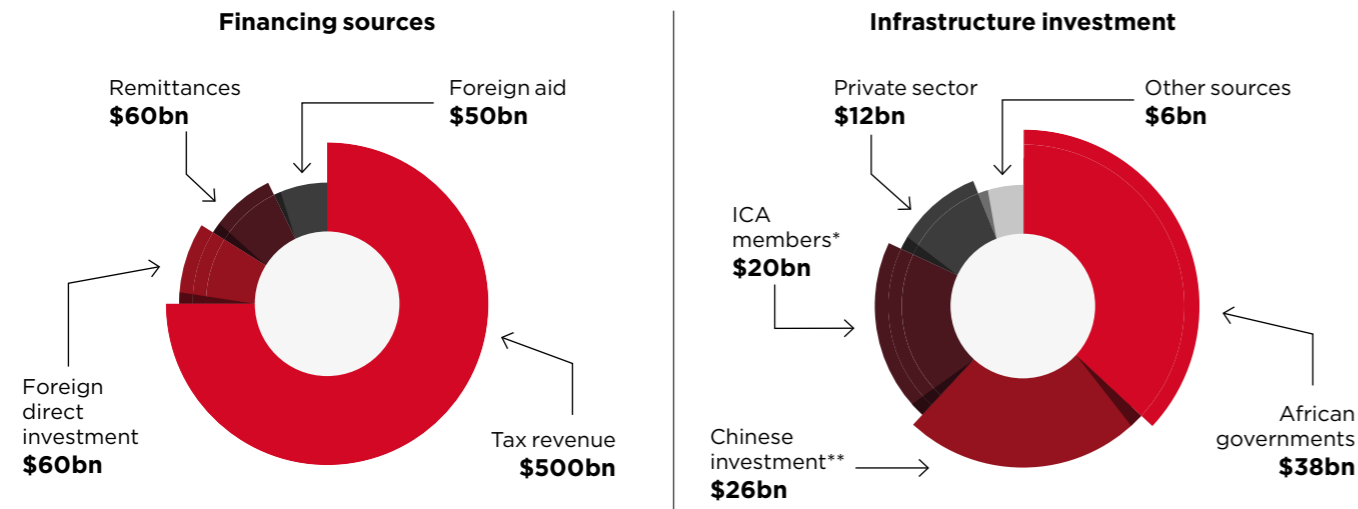
Sources of infrastructure financing

This section looks at the funding and financing trends in transport and what this means for digital adoption. The first and most fundamental observation is that transport infrastructure financing rests heavily on the public sector.[67] Figure 11 outlines the total financing sources on the continent broken down by infrastructure investment. In both cases, African governments are the single largest source of expenditure. Within infrastructure spending, transport is one of two big ticket items. Globally, transport accounted for 45% of all the infrastructure investments analysed, but in Sub-Saharan Africa, investments were weighted slightly more to energy than the global average.

Infrastructure investment in transport

Research by the Infrastructure Consortium for Africa (ICA) found that national budget allocations to the transport sector were $19 billion in 2020, or 56% of infrastructure-related budget allocations.[68] Globally, Sub-Saharan Africa has the lowest rate of private sector participation in transport investment: just 6% of compared to 9% in Middle East and North Africa (MENA) and Europe and Central Asia (ECA), 12% in Latin America and the Caribbean (LAC), 13% in East Asia and Pacific (EAP) and 17% in South Asia Region (SAR). In the transport sector, both globally and in Sub-Saharan Africa, road and airport expenditure dominate investments, although the distribution of this expenditure differs by source. The small amount of private expenditure investments tracked in Sub-Saharan Africa focused heavily on ports. Meanwhile, the vast majority (86%) of government expenditure focused on roads (50%) and rail (36%).

66. Safaricom. (n.d.). "Taxi Hailing App Little Now Available Via USSD".
67. Foster, V., Rana, A. and Gorgulu, N. (2022). *Understanding Public Spending Trends for Infrastructure in Developing Countries*.
68. The Infrastructure Consortium for Africa (ICF). (n.d.). "Spending by African governments on infrastructure".

Figure 11

Total financing sources in Africa broken down by infrastructure investment

Financing sources

Remittances
$60bn

Foreign aid
$50bn

Foreign direct investment
$60bn

Tax revenue
$500bn

Infrastructure investment

Private sector
$12bn

Other sources
$6bn

ICA members*
$20bn

Chinese investment**
$26bn

African governments
$38bn

Source: Financing sources, AFDB (2018) African Economic Outlook; Infrastructure investment, Infrastructure Consortium for Africa.

*ICA members outlined here: https://www.icafrica.org/en/about-ica/ica-members

** ICA reported investments from both state-owned enterprises and private corporations using data from AEI. Data can be found here: https://www.aei.org/china-global-investment-tracker/

Financing to start-ups

Start-ups are the engine of digital innovation. As part of our analysis of the transport funding landscape, we conducted an analysis of the deals tracked in Africa: The Big Deal database. This database tracks all tech start-up funding deals over $100,000 for companies with headquarters in an African country, or elsewhere with an African founder. As such, this data excludes some inward investment from companies not based on the continent or with African founders, non-tech investments in transport start-ups. Only publicly announced deals are included. Despite this, the data provides insight into Africa's innovation funding landscape and a signal of where the market is headed.

Since 2019, the Big Deal database has tracked just under $13 billion in deals across 12 key sectors. Fintech has attracted the most funding by far, registering just over $6.2 billion in funding. Transport and logistics is the third largest sector by funding, with $1.4 billion in deals tracked in the last four years. Figure 12 shows the sector funding trends for all deals tracked. Transport and logistics have seen strong growth year over year with a compound annual growth rate (CAGR) of 78%, and 2022 saw a 38% increase in deal value from

2021, from $449 million to $621 million. This share of funding has not changed significantly in the last four years (right-hand panel).

The $1.4 billion that has gone into transport and logistics has been channelled into 161 companies and 255 deals/funding rounds. To understand where this funding was flowing, we reviewed all the companies and coded them by their main focus in the transport sector, the main value proposition of their solution and whether their solution includes a manufacturing or financing offer.
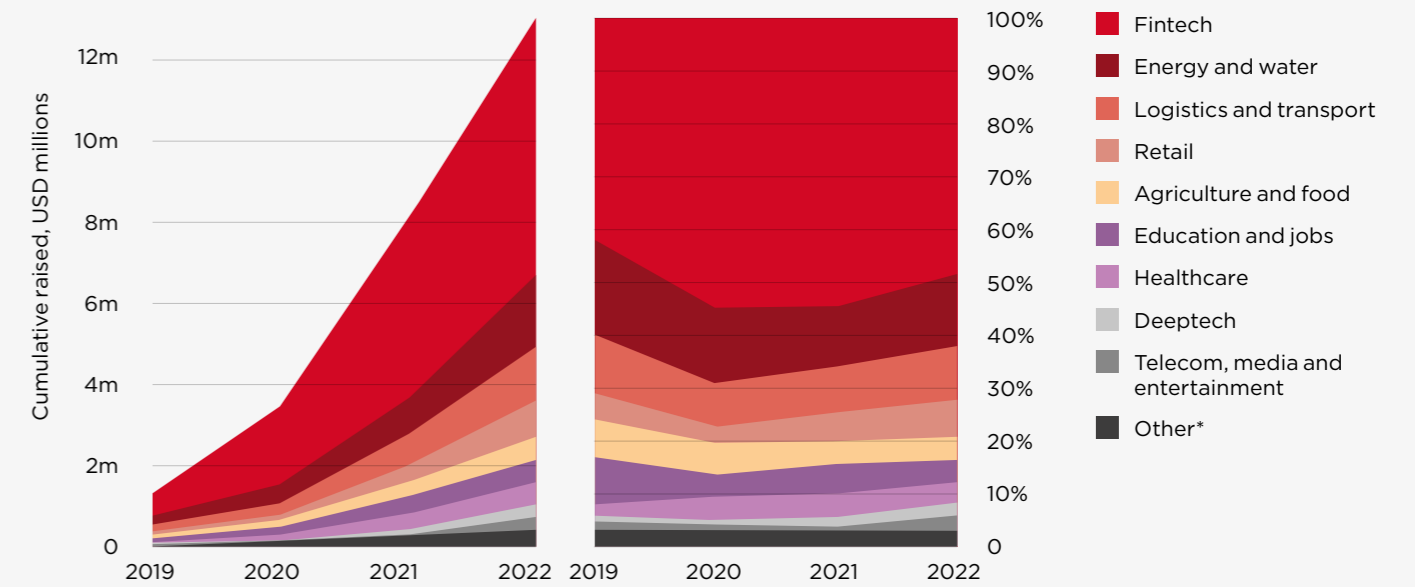
In terms of sector, most funding goes to passenger solutions, which account for about 48% of deal value. Multi-tier solutions that cut across both transport and logistics account for roughly a quarter of deal value, roughly the same proportion as logistics-focused solutions.

Financing trends in logistics

Digital platforms dominate in logistics, but vary across different sectors. A key trend in the logistics sector are solutions that support e-commerce and allow for delivery tracking and warehousing solutions. There are many companies that combine physical infrastructure with digital platforms to manage the movement of goods. A second major
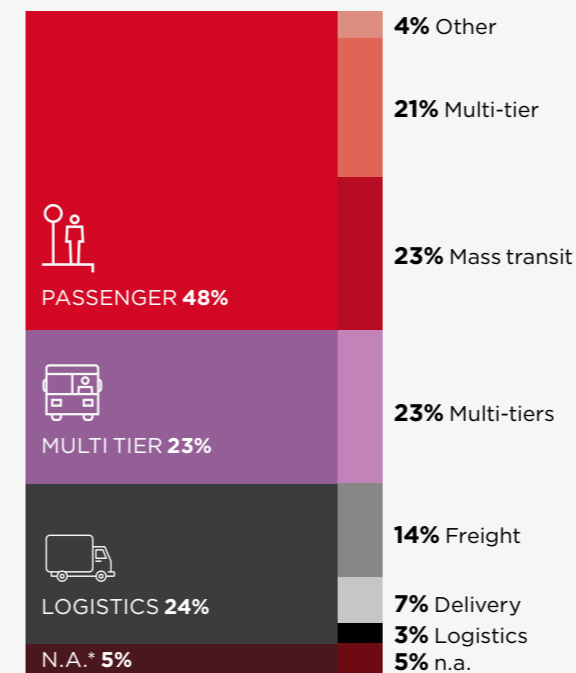
Figure 12

Cumulative investment by sector 2019–2022 (USD, millions)

Legend:
- Fintech
- Energy and water
- Logistics and transport
- Retail
- Agriculture and food
- Education and jobs
- Healthcare
- Deeptech
- Telecom, media and entertainment
- Other*

* "Other" is the total for Housing ($68 million since 2019), Waste management ($94 million) and Services ($262 million)

Figure 13

Proportion of sector funding distribution by solution

PASSENGER **48%**
- **4%** Other
- **21%** Multi-tier
- **23%** Mass transit

MULTI TIER **23%**
- **23%** Multi-tiers

LOGISTICS **24%**
- **14%** Freight
- **7%** Delivery
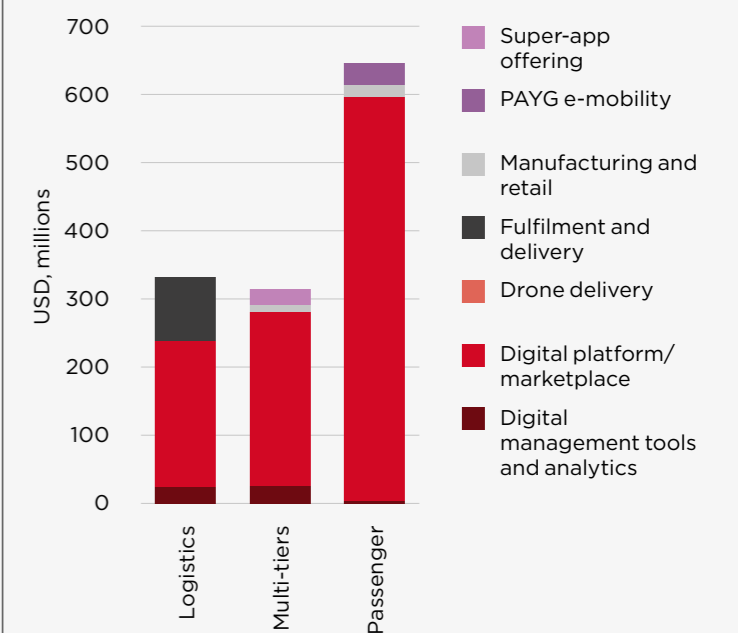- **3%** Logistics

N.A.* **5%**
- **5%** n.a.

*Note: for some companies in the database there was insufficient information to code focus, they had pivoted away from transport or deal details were confidential. These companies are marked "n.a.".

Source: Authors' analysis of Africa: the Big Deal database

Figure 14

Distribution of funding compared across logistics, passenger and multi-tier sectors in transport

Legend:
- Super-app offering
- PAYG e-mobility
- Manufacturing and retail
- Fulfilment and delivery
- Drone delivery
- Digital platform/ marketplace
- Digital management tools and analytics

Source: Authors' analysis of Africa: the Big Deal database

group of solutions are business-to-business (B2B) logistics platforms for matching shippers to truck drivers, again, with tracking and reliability a key part of the value proposition. The emergence of these solutions is significant for supporting regional and international trade, and many of these companies will be key partners as e-commerce establishes on the continent. E-commerce penetration in Africa is about 32% currently,[69] so there is plenty of room to grow, and sound logistics and delivery alongside effective payment solutions are key to supporting a sector that is likely to contribute to economic growth.

Financing trends in passenger transport

The story of passenger transport in Africa can be told, at least in part, by the three leading companies. Together, Moove, Swvl and Yassir have raised close to $700 million in the last four years, almost half of the total deal value in the sector in this period.

— **Ride hailing is clearly part of the picture with mobility start-ups, and Yassir has successfully expanded across North Africa and into Europe and North America**. Although not included in this analysis due to their pivot to fintech, it is notable that MNT-Halan recently became the continent's ninth unicorn and began life as a ride-hailing platform. Similar to ride-hailing apps globally there is a clear trend for these platforms to expand into other areas and towards a super-app offering.

— **Moove's success tells a different part of the ride-hailing story: filling the need for access to vehicle financing**. Moove offers this on a revenue-share basis as drivers are approved for finance only if they use the vehicle to drive on the partner ride-hailing platform. There are also other digital marketplaces for second-hand and new cars that offer more traditional financing, like Sylndr and Autochek.

— **Swvl's success is the story of transport systems in many LMIC cities**. Their platform allows the booking of privately owned mass transit operating on fixed routes, as well as other B2B and business-to-government (B2G) offerings. Their success speaks to the need for coordination in a fragmented mass transit market where the line between public services and private ownership is often blurry.

Table 1
Leading companies in logistics, deal value 2019-2023

Solution type	Example companies	Total raised
B2B platforms for matching shippers to truck drivers with asset tracking and other services	Kobo360	$78 m
	Trella	$54 m
	Lori Systems	$34 m
	Naqla	$11 m
All-in-one warehousing and delivery, and logistics services	Sendy	$22 m
	Sote	$11 m
B2B parcel delivery for e-commerce	Mylerz	$10 m
	Bosta	$13 m
Platform for small shops to source fast-moving consumer goods (FMCG)	Jabu	$18 m
Platform for food ordering and delivery	Elmenus	$18 m
E-commerce enablement	Sabi	$28 m

Source: Authors' analysis of Africa: the Big Deal database

Finally, it is encouraging to see early-stage investment in mobility start-ups seeking to manufacture e-vehicles in Africa. This sector is key to a green energy transition in transport and, as with other offerings, many of these companies offer financing or pay-as-you-drive options.

Deal type and financing sources

Although the current funding mix largely reflects the success of Africa's three leading mobility companies, there is a strong pipeline of series A and B funding rounds closing in transport, hinting at continued growth for the sector. Additionally, the growth of debt financing in the sector suggests that many companies are on a firmer financial footing. Aside from investments from many of the most active VCs on the continent – e.g. Saviu ventures, Techstars, Flat6labs, On Deck, Kepple – there have been some direct investments from

69. Statista. (30 November 2022). *E-commerce penetration rate in Africa 2017- 2027*

Table 2
Leading companies in passenger travel, deal value 2019-2023

Solution type	Example companies	Total raised
Revenue-based vehicle financing platform for the ride-hailing market	Moove	$266 m
Digital platform for accessing mass transit	Swvl	$252 m
Ride hailing / super-app	Yassir	$180 m
	Gozem	$16 m
Electric mobility manufacturing and supply	Max	$63 m
	Ampersand	$13 m
	Basi-go	$12 m
	Shift-EV	$9 m
	JET Motor	$9 m
	Roam*	$8 m
Marketplace for second-hand vehicles	Autochek	$17 m
	Sylndr	$13 m
Mobility data and services	WhereIsMyTransport	$24 m

* Formerly Opibus | Source: Authors' analysis of Africa: the Big Deal database

global logistics and transport companies into the African ecosystem. Mobility54, a mobility-dedicated Corporate Venture Capital (CVC) for Africa that's part of the Toyata group, has been making many early stage investments in companies.[70] Logistics giant DPDgroup has also been active in multi-investor rounds, and DHL has taken stakes in e-commerce start-ups.[71]

Looking forward

In passenger transport, the need for clean mobility solutions is clear, and successful companies are bringing tailored offerings that address some of the most pressing needs: access to finance for individuals, coordination in a fragmented sector and accelerated adoption of electric mobility. In the logistics sector, the focus of companies heralds the emergence of e-commerce, and responds to some of the long-standing challenges in facilitating regional and global trade and accurately tracking goods to their point of delivery. These logistics start-ups are building a foundation to support broader tech adoption and economic growth. An interesting question, and challenge, is how far these solutions will penetrate to meet the needs of low-income urban populations, who currently face some of the greatest mobility challenges.

70. For example: Kenyan Logistics Startup Raises $20M, Gets Toyota's Backing

71. For example: DHL acquires stake in Link Commerce developed by MallforAfrica

Figure 15
Annual investments by type, USD millions
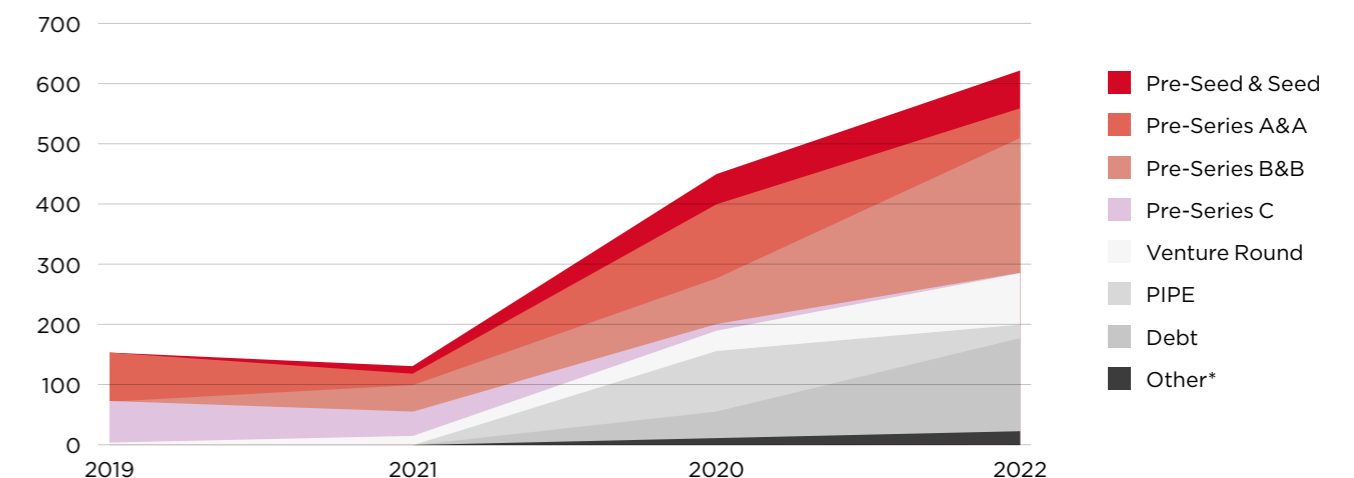
Source: Authors' analysis of Africa: the Big Deal database

Source: AC Group
A user making a cashless payment in Kigali

4.1 Digitalising payments: Kigali

Kigali, Rwanda's capital, has undergone tremendous development in the past few years. Guided by well-developed policies, the city has been lauded as the cleanest and safest on the continent. The city has also focused on building efficient transport systems that support both motorised and non-motorised modes of transport. In 2012, the Ministry of Infrastructure formulated an action plan to develop an integrated public transport system for Rwanda.[72] One of the problems identified during this project was a lack of integrated transport ticketing and revenue-sharing mechanisms, despite Kigali being a multi-route and multi-operator environment. A fare policy that maximised income for operators and maintained low fares for users, while also supporting universal access to transport, was recommended. The report also recommended that an expert group should advise on integrated smart ticketing and a comprehensive survey should be conducted.

In 2015, the Rwandan government awarded AC Group, a local tech firm providing smart transport solutions, the contract to implement digital payments. AC Group developed the Tap&Go card as a payment solution.[73] Tap&Go is a contactless smart card on which users can load money through a service agent as well as mobile money, and can be used across different bus companies. When it launched, the card helped to ensure that fares were stable and reduced the amount lost due to leakage between the driver and the conductor. This technology has helped to recover at least 30% of lost revenue, which would be invested in the purchase of more buses to improve the transport system.[74] Over time, AC Group added a fleet management system as part of their solution,

tracking buses in real time and updating the bus schedules. There are currently more than 2 million card holders, and the solution has facilitated more than 298 million trips. The public-private partnership between the City of Kigali and AC Group has contributed to its success.

AC Group's success is considered exceptional compared to efforts to digitalise public transport payments in Kenya. In 2014, the government mandated the use of cashless systems in all public vehicles in a move to regulate the privately operated public transport system. However, key players in the sector, such as bus owners and drivers, were not consulted and some problems arose when it was implemented.[75] Different companies had released their own cards, but the systems were not interoperable. Operators also began to sabotage the cashless process as they could no longer hike fares as they pleased. Eventually, the project had to be abandoned. Despite this failure to implement digital payments on public transport in Kenya, the onset of the COVID-19 pandemic led to an increase in mobile money payments for transport aimed at curbing COVID transmissions through contact.

4.2 Data for planning: GoMetro

Data is a key component of urban planning solutions and the effective provision of essential utility services.[76] While data collected on public transport has historically been limited, innovative forms of data are improving this process and informing the policies necessary to improve the sector and make transport more efficient. This data is generated primarily by digital services, including mobile operator data, remote-sensing data, private utility service provider data, as well as other digital services data, such as social media and web browser data. Mobile operators' data on travellers' mobility patterns can be used to improve trip planning and maximise the efficiency of different routes and transport options. Combining and using call detail record (CDR) data, location-generated databases can be created to determine traffic patterns from a smaller (regional) to larger (national) level and

72. Republic of Rwanda Ministry of Infrastructure. (October 2012). *Public Transport Policy and Strategy for Rwanda*
73. AC Group. (n.d.). "Defining Smart Transport".
74. Startup Guide. (28 June 2021). "How AC Group reinvinted Kigali's public transport".
75. Mondato. (1 January 2019). "Cashless transportation: Kenya and Rwanda as case studies".
76. Kong, J. et al. (2021). *Innovative Data for Urban Planning: The Opportunities and Challenges Associated with Public-Private Data Partnerships*. GSMA.

4 Case studies

Figure 16

GoMetro Urban Mobility Observatory update

Online Survey and UMA

Measure
- User movement Analytics (UMA)
- Web Surveys
- Mobile-ad serving engine
- 3rd Party APIs
- Desktop data
- Traffic / Incident

GoMetro Pro data campaign manager

Manage
- 29 City Management Zone
- Shapes / City & Census Data
- Statistical targets per zone / City
- Survey Questions / Calibration
- Viewer / Reports / Maps Builder
- In-app UMA integrations
- Ad-Buy Analytics

TAZ Model per city

Measure
- UMA Trip & Mode Detector algorithms
- 3rd Party-APIs (Tomtom, PTV)
- GTFS (Mapping)
- Travel time calculations
- KPI value & accuracy calculations

Campaign website and Online data viewer

Move
- Journey Planner (29 Cities)
- KPI Explorer Website
- Landing Page Campaign explainer
- Online Survey Landing Pages
- Spanish / Portuguese / English
- Regional Apps Integrations

provide historical analysis statistics, which also help transport policy measures.

South African GoMetro, a transit information app used across Africa, utilises a mobile app for the in-field data collection of public transport operations. The app has been used extensively for various projects in the mini-bus taxi industry and to help determine the business value of this type of transport. The solution can also conduct network discovery, determine route and vehicle profiling, monitor bus systems and collect passenger travel information.[77] The data is then automatically uploaded to a web-based data management platform and converted to a general transit feed specification (GTFS) standard format.

Through the UK-AID funded High Volume Transport programme, GoMetro partnered with several municipal governments across Africa to support mapping projects and other data collection initiatives. In partnership with the municipal government of Kigali and the Ministry of Infrastructure, GoMetro provided data that informed the redesign of their 450-bus network and optimisation of routes. They have also worked in Gaborone and Maseru to map mini-bus taxi routes.

The Digital Transport for Africa (DT4A) initiative, coordinated by the World Resources Institute (WRI) and funded by Agence Française de Développement (AFD), aims to create a collaborative digital commons for innovative transport data on African cities. Through this initiative, GoMetro intends to collect mini-bus taxi data in Stellenbosch, South Africa.[78] This data will inform a business feasibility model for the transition from diesel to electric mini-buses, reducing the informal fleet's carbon footprint.

4.3 E-mobility: Ampersand

As the uptake of electric vehicles increases around the world, innovators are starting to offer e-mobility solutions on the continent. Ampersand, an energy and mobility start-up based in Rwanda, is paving the way in electrifying motorcycles. They began their journey in 2019 with 20 electric motorcycles in Kigali, and now have 13 battery swapping stations across Kigali and Nairobi and perform about 37,000 battery swaps each month.[79] Since their launch, Ampersand has more than 600 motorcycles on the road that have covered more than 17 million km, with each motorcycle saving 2.5 tonnes of carbon emissions annually.
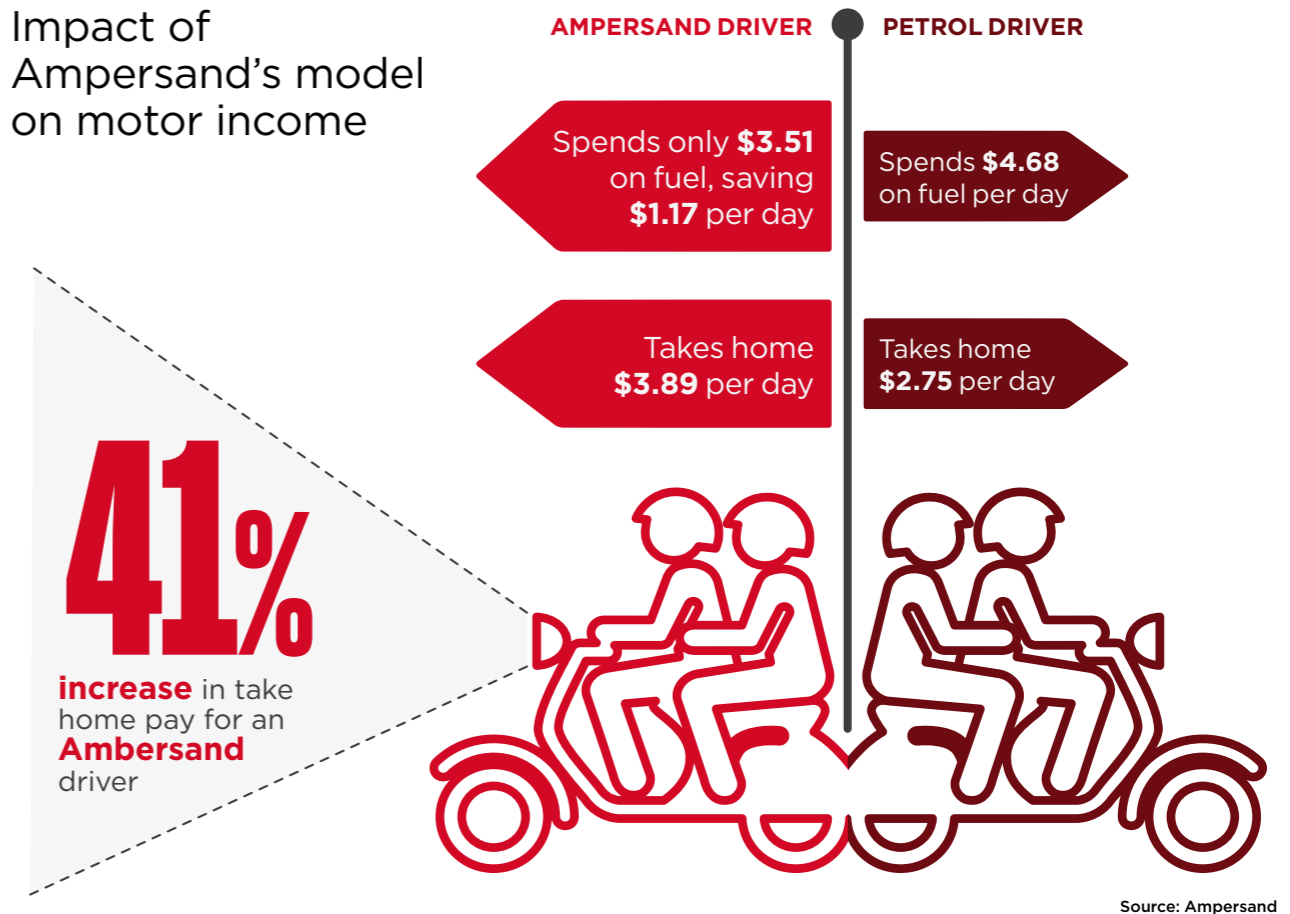
77. Jia, W. et al. (2022). *Improving Paratransit in Maseru and Gaborone : Using Innovative Data Techniques in a Diagnostic Approach to Inform Strategy*. World Bank.
78. WRI. (14 June 2022). "WRI and Partners Select 4 Winners for Digital Transport for Africa Innovation Challenge".
79. Ampersand. (n.d.). "New Zealand Foreign Affairs Minister inaugurates Ampersand E-Motorbike Battery Swap Station in Kigali, Rwanda".

Figure 17

Impact of Ampersand's model on motor income

AMPERSAND DRIVER | **PETROL DRIVER**

Spends only **$3.51** on fuel, saving **$1.17** per day

Spends **$4.68** on fuel per day

Takes home **$3.89** per day

Takes home **$2.75** per day

41%

increase in take home pay for an **Ambersand** driver

Source: Ampersand

While the initial cost of purchase for most electric vehicles is often higher than a fuel vehicle, Ampersand's motorcycles cost less than petrol-powered ones. Riders can purchase the motorcycles upfront or lease under the pay-as-you-drive model. Ampersand will then rent out charged batteries to the riders, which saves them the upfront cost and risk of buying a lithium battery pack. The swapping stations ensure that drivers do not have to wait for the batteries to charge, which could result in lower revenue. Additionally, the cost of maintenance and power is half that of regular motorcycles, increasing riders' revenue by up to about 40%.

Ampersand's motorcycles can achieve a top speed of 80 km/h and feature regenerative braking and a shift-free transmission. The batteries are equipped with fast-charging and passive cooling technologies, as well as a smart battery management system with online telematics, delivering a range of 60–90 km with every full charge. The management system allows Ampersand to analyse battery health, understand the return on investment (ROI) of each station, driver and battery, as well as create geofenced alarms.

Strategic partnerships have been crucial to Ampersand's growth. In Rwanda, they have partnered with Bboxx, an asset-financing platform that provides technology and financing to millions, to finance tens of thousands of motorcycles in the coming years.[80] Leveraging Bboxx's AI asset financing model and mobile payment-enabled operating system, this partnership will make the motorcycles more affordable to most riders. Besides Bboxx, other off-grid solar companies such as Altech Group and M-Kopa have shown interest in e-mobility, highlighting the convergence of e-mobility and clean energy solutions. In Kenya, Ampersand has partnered with TotalEnergies, a leading energy provider in the country, to set up charging and swapping stations at their service stations. TotalEnergies Kenya has a wide network of more than 200 service stations across the country, which Ampersand can leverage to expand and reach more markets.

80. Kuhudzai, R.J. (12 October 2022). "Bboxx Partners with Ampersand to Provide Thousands of Electric Motorcycle Taxis for Riders in Rwanda". *CleanTechnica*.

5 Conclusions and recommendations

With an additional 900 million people expected to live in African cities by 2050, deliberate efforts are needed to plan and manage public services and infrastructure on the continent. Rapid urbanisation is putting pressure on urban mobility and will require better transport systems to ensure that city residents have access to job opportunities, health care, education, leisure activities and other services.

Digital solutions can ease mobility across cities by unlocking unique business models in the transport sector, and enabling urban planning interventions that cater to the needs of low-income residents. These innovative solutions are also encouraging more integrated, multi-modal transport systems able to provide more reliable and affordable services to low-income urban populations, while also allowing cities to strengthen their public transport systems. Today, challenges such as congestion, high travel costs and insecurity are being solved through innovative solutions across African cities.

Digitalisation has also driven inclusion in the transport industry. It is now easier for women to report harassment, track and share their trip status with others in real time and even request women drivers on certain ride-hailing apps. For people living with disabilities, intelligent traffic light systems and mobile apps that have special provisions for ride hailing are making transport more accessible. Digital technology has also led to the proliferation of these digital platforms, more affordable EVs through pay-as-you drive models and seamless digital payments for public transport.

Incorporating digital technologies in transport also provides avenues for public-private collaboration, such as data-sharing partnerships, regulation and infrastructure planning and development. For instance, data from private ride-hailing services and MNO data can be leveraged by transport authorities to better understand traffic flow patterns in cities and plan for relevant service extensions.

The opportunity offered by digital solutions will also accelerate the transition to e-mobility, as these solutions are already playing a critical role in deploying and enabling charging infrastructure and vehicle financing, both in the transport sector and the wider utility ecosystem. Through the GSMA Innovation Fund, we have seen the value of digital solutions in the energy sector, and it is interesting that many of the pioneers in the off-grid energy sector in Africa (M-Kopa, BBOXX) have also announced recent initiatives in the e-mobility sector. Since e-mobility sits at the intersection of the transport and energy sectors in LMICs, innovative use cases such as portable battery models will likely continue to proliferate.

City officials, donors, enabling organisations and innovators working in the transport sector will need to collaborate to take advantage of the digital opportunity. While this research has provided an overview of some of the emerging opportunities at the intersection of digital innovation and transport in Africa, this report raises other research questions and topics, such as:

— **Increasing financing for the transport sector:** digital technologies enable innovative financing mechanisms that could be leveraged to finance transport service providers

— **Increasing the efficiency and reliability of transport systems in cities and between urban and rural areas:** as clusters of cities emerge across Africa and secondary cities gain prominence, their linkages need to be strengthened to grow economies. Intra-city transport systems and service provision will be vital.

— **The emergence of platform models in the transport sector:** Digital platforms enable many new opportunities for riders and users, but they are also associated with a range of potential risks and drawbacks. How can cities ensure they benefit from innovations while also safeguarding riders and users from risks?

Recommendations

Improving transport systems in African cities through digital solutions requires the coordination of different stakeholders, from innovators to city authorities, enabling organisations and public and private donors.

DONORS

Provide early-stage capital to enable pilots and scale-ups that can drive the adoption of digital solutions and innovative business models

Support research that showcases innovative transport use cases associated with the greatest development outcomes

Fund and build the capacity of regulators and transport authorities in LMICs to take advantage of innovative use cases while also protecting users and riders from their potential risks

GOVERNMENTS AND CITY

Adopt a bottom-up approach to managing transport services to understand the needs of the entire urban population Integrate the use of data in urban planning processes

Integrate the use of data in urban planning processes

Create policy that allows and encourages private actors to work in the sector

Empower local governments to be at the forefront of transport planning

Ensure that the needs of minorities are taken into account when considering regulatory interventions (users, low-income riders, women, persons with disabilities, other commuters, the city as a whole)

ENABLING ORGANISATIONS

Support capacity building for the public sector to understand the role of technology in transport

Bring together private and public stakeholders

Promote the adoption of standards for emerging business models, such as digital platforms or ride-hailing services

MOBILE OPERATORS

Engage with the public sector to develop data-sharing systems that support informed decision-making in urban planning

Have dedicated teams to support innovators that want to integrate mobile services in their models

INNOVATORS

Develop solutions that have value for both transport users and riders

Leverage innovation to make the transport sector more inclusive and build a more equitable future for women and low-income residents

Adopt standards to reduce the risks associated with some innovative business models

GSMA