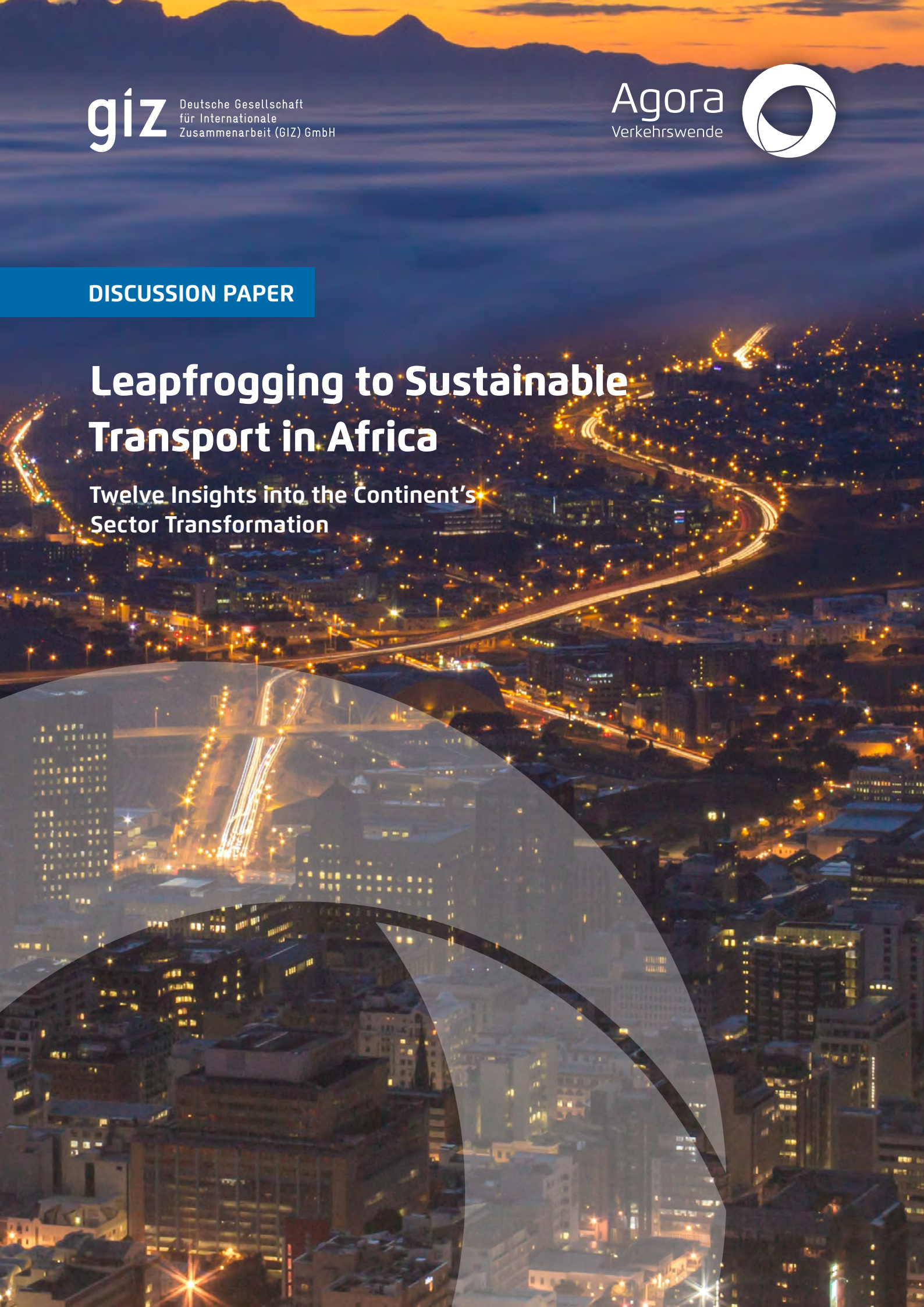




DISCUSSION PAPER

# Leapfrogging to Sustainable Transport in Africa

Twelve Insights into the Continent's  
Sector Transformation



# Impressum

## Leapfrogging to Sustainable Transport in Africa

Twelve Insights into the Continent's Sector Transformation

## PUBLISHED BY

### Agora Verkehrswende

Anna-Louisa-Karsch-Str. 2 | 10178 Berlin | Germany  
T +49 (0)30 700 14 35-000  
F +49 (0)30 700 14 35-129  
www.agora-verkehrswende.de  
info@agora-verkehrswende.de

### Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

Registered offices (Bonn and Eschborn):  
Friedrich-Ebert-Allee 40  
53113 Bonn | Germany  
P: +49 (0)228 44 60-0  
F: +49 (0)228 44 60-17 66

Dag-Hammarskjöld-Weg 1-5  
65760 Eschborn | Germany  
P: +49 (0)61 96 79-0  
F: +49 (0)61 96 79-11 15  
info@giz.de | www.giz.de

## IMPLEMENTATION

### Authors

Daniel Bongardt, Christian Hochfeld, Verena Knoell,  
Elisabeth le Claire, Ernst-Benedikt Riehle, Fritz Vorholz

**Translation/Proofreading:** Lucais Sewell

**Layout:** Marica Gehlfuß

**Cover image:** Marlin Clark/Unsplash  
Cape Town, South Africa

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## PROJECT MANAGEMENT

Ernst-Benedikt Riehle  
ernst.riehle@agora-verkehrswende.de

Elisabeth le Claire  
elisabeth.leclaire@agora-verkehrswende.de

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# Foreword

All eyes turned to Africa at the COP27 climate conference, held in Egypt in November 2022. This attention was long overdue. Home to 1.4 billion people, Africa is a diverse melting pot of transitioning economies, ecosystems, and societies. In recent decades, its nations have grown and reinvented themselves as they have shifted from developing to emerging countries. In Africa, change is a proverbial constant, and today this is more visible than ever – in ways both encouraging and concerning.

On the one hand, Africa is home to a vibrant young population that embraces technology and innovation. This, in combination with the continent's extensive natural resources, has been propelling economic transformation. On the other hand, Africa faces serious structural challenges, multilateral dependencies, and political instability. What is more, although Africa is least responsible for climate change, its effects endanger livelihoods on the continent like nowhere else. Finally, international crises, geopolitical discord, and disruptions to global supply chains have the potential to negatively impact prosperity, thus putting Africa's populations at greater risk.

This report aims to bring global attention to an important aspect of the continent's climate agenda: transforming the mobility of people and goods.

As institutions engaged in global discussion on sustainable transport – namely, a think tank devoted entirely to the subject (Agora Verkehrswende), and a government agency for international development cooperation (GIZ) – we have observed tremendous growth in international awareness for the urgency of decarbonization since the Paris Agreement of 2015. In the past few months, we saw an unprecedented number of commitments from national governments and cities to decarbonize the transport sector. Companies across the globe have also shown increasing eagerness to advance the cause of sustainability.

These are welcome developments. However, transport remains the only sector that has not seen a notable reduction in CO<sub>2</sub> emissions since 1990. Indeed, emissions are still trending upward. In emerging economies and industrialized nations alike, motorization levels and transport volumes continue to grow, increasing sector emissions.

While the topic of sustainable transport has stimulated intense debate in many countries and regions, this

debate has been slow to gain traction in Africa, the only continent whose economies and populations are still growing fast and discussions focus on infrastructure development.

In many parts of the world, a clear consensus has emerged concerning the need to reduce reliance on fossil fuel-based mobility. But does this consensus hold true for the African continent, a complex amalgam of nations and urban settlements on the brink of unprecedented growth? How will transport shape the way Africa's nations face climate change?

Will future discussions focus on the transformation of the African transport sector – that is, on a remaking of mobility in the manner of a *Verkehrswende* (as one says in German)? Or will we instead witness a leapfrogging to new technologies, as was seen in the telecommunications sector? Moreover, what will be the proper terminology for describing associated developments in African transport?

With these questions in mind, we initiated a dialogue with a wide range of participants. After extensive internal deliberation, we solicited contributions from leading German institutions working in Africa, and then hosted a series of discussion groups with African experts.

The twelve insights that emerged from this process are based on data as well as on subjective assessments. They are a synthesis of perspectives concerning the realities, potentials, and exigencies of transport in Africa, both now and in the future. Of course, in light of the diversity and complexity of the African continent, our findings are necessarily provisional, and require further input from African stakeholders.

Accordingly, this paper represents the first step in a longer journey. Our goal is to kick off discussion not only in Africa but in Europe and at international scale as well. For the climate crisis can only be managed with the engagement of the entire global community. And an Africa that is prosperous, sustainable, and resilient will be crucial to overcoming the challenges that lie ahead.

**Christian Hochfeld** (Agora Verkehrswende) and  
**Daniel Bongardt** (GIZ)  
Berlin, June 2023

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Picture: peeter v/stock

## Intro- duction

Sustainable transport is a collective endeavor.

Africa impresses in many ways. It is the second largest continent on Earth, stretching some 8,000 kilometers from the Mediterranean Sea in the north to Cape Agulhas in the south, spanning deserts, rainforest, and savannahs. More importantly, Africa is home to nearly 1.4 billion people, about one-fifth of the world total, and over 2,000 distinct tongues, 50 of which are considered major languages. Its population is young and growing faster than that of any other continent. Although most Africans (57%) live in rural regions, the speed of Africa's urbanization is unprecedented, and has already turned Cairo, Kinshasa, and Lagos into megacities; others will follow soon.

## Africa's diversity defies generalization

There are wide variations in the economic structure of African countries. Some (Nigeria, Libya, Angola) export petroleum almost exclusively, leaving their economic development heavily dependent on oil prices. In other countries, economic activity is dominated by agriculture, performed in many places at the subsistence level. Public debt as a percentage of GDP has at times ranged from 18.2% (in Botswana) to 250% (in Sudan), while inflation has gone from 1.32% (in Seychelles) to over 250% (in Zimbabwe)<sup>1</sup>. In northern Africa, almost everyone has access to electricity, including those who live in rural areas. By contrast, only five percent of the rural population in the countries of central Africa have electricity<sup>2</sup>.

These geographic and economic disparities mirror those in other areas of African society. Large parts of the population use mobile phones to make purchases and transfer money; others have barely enough money to buy a mobile phone. In some African states such as Rwanda the gender equality is more advanced than in many countries of the Global North; in others, such as Chad, women face large disadvantages.

In view of the immense contrasts within Africa and its regions, generalizations are of limited value. And yet African nations do share important commonalities – shaped by history and by the challenges they face today.

The history of the continent is as old as the history of mankind and too extensive to fully give credit to in a short paragraph. It covers great empires and civilizations from ancient Egypt to the Kingdom of Kongo. Migratory movements like the Bantu expansion and economic and political relations shaped the diversity of the continent. In the 19th century, Europe's imperial powers occupied almost the entire continent. They exploited people, mineral resources, and agricultural products and drew arbitrary borders that disregarded ethnic and cultural realities. This colonial legacy and persisting postcolonial dependencies and structures continue to have an impact today: in many African states, the political situation is unstable, per capita income is low, national debts, including those to former colonial powers are high and main transport infrastructure is focused on raw material extraction and export.

It is true that some African states have risen from low- to middle-income countries in recent years. But most of world's least economically developed countries are still located in Africa, despite the continent's rich reserves of raw materials, large potential labor force, and record-high GDP growth prior to the COVID pandemic. Moreover, in no other continent is the gap between rich and poor as wide as it is in Africa.

## Climate vulnerability requires urgent action

Like everywhere, people with low incomes are particularly vulnerable to the effects of global warming. In many regions of Africa, high average temperatures have already risen by more than 1°C, and the number of heat waves and extremely hot days have increased. Sea levels are rising worldwide, but on some African coasts, they are rising much faster than the global average. What is more, rainfall patterns have changed, with serious implications for agricultural yields and food security. Extreme weather events threaten the health, safety, and lives of many people, and increase the likelihood of violent conflict.

Studies show that between 1980 and 2016, one in three conflicts in fragile states was preceded by natural disasters<sup>3</sup>. Both floods and droughts are becoming more frequent and intense, and they are affecting socio-economic

1 Trading Economics 2022

2 World Bank 2019

3 Ide et al. 2020

development. It is estimated that the 1°C of global warming that has already occurred will noticeably reduce Africa's GDP growth; as temperatures rise, the expected losses will grow disproportionately. But even today, climate change is destroying people's livelihoods. It is already a reason for migration, and in the future, it will cause increasing numbers of people to resettle. There is much to suggest that climate change will also worsen the credit rating of African states, with serious macroeconomic consequences.

## Transport is a potential driver of emission growth

Petroleum now accounts for around a quarter of Africa's energy supply and is the most important energy source on the continent. It is thus no surprise that the transport sector plays a central role in CO<sub>2</sub> emissions: 29% of total CO<sub>2</sub> emissions from the combustion of coal, crude oil, and natural gas are attributable to the transport sector, and most of that comes from road vehicles. The next greatest emitters in Africa are coal-fired power plants, though they come in at a distant second<sup>4</sup>.

Although Africa has contributed little to global warming thus far, the continent's growing population has the potential to become a significant greenhouse gas emitter. If global warming is to be kept below 2°C relative to pre-industrial times, Africa's CO<sub>2</sub> emissions too will have to peak soon and fall to net zero by the end of the century. The transport sector will have an important role to play in the reduction of the continent's emissions.

The reason is because Africa's motorization is still in its early stages. Of the nearly 950 million passenger cars on the road worldwide in 2015, just under 31 million were in Africa; commercial vehicles are also comparatively rare on the continent. Unlike Europe, America, and large parts of Asia, Africa still has a chance to avoid negative lock-ins, such as urban development focused on privately owned vehicles and high-emission transport systems. However, this process has a chance of succeeding only if it goes hand in hand with overcoming poverty and increasing prosperity. It is not about merely introducing some policies for the environment or the climate; it is about giving an entirely new direction and impetus to socio-economic development.

## Aligning transport with SDGs and the Paris Agreement

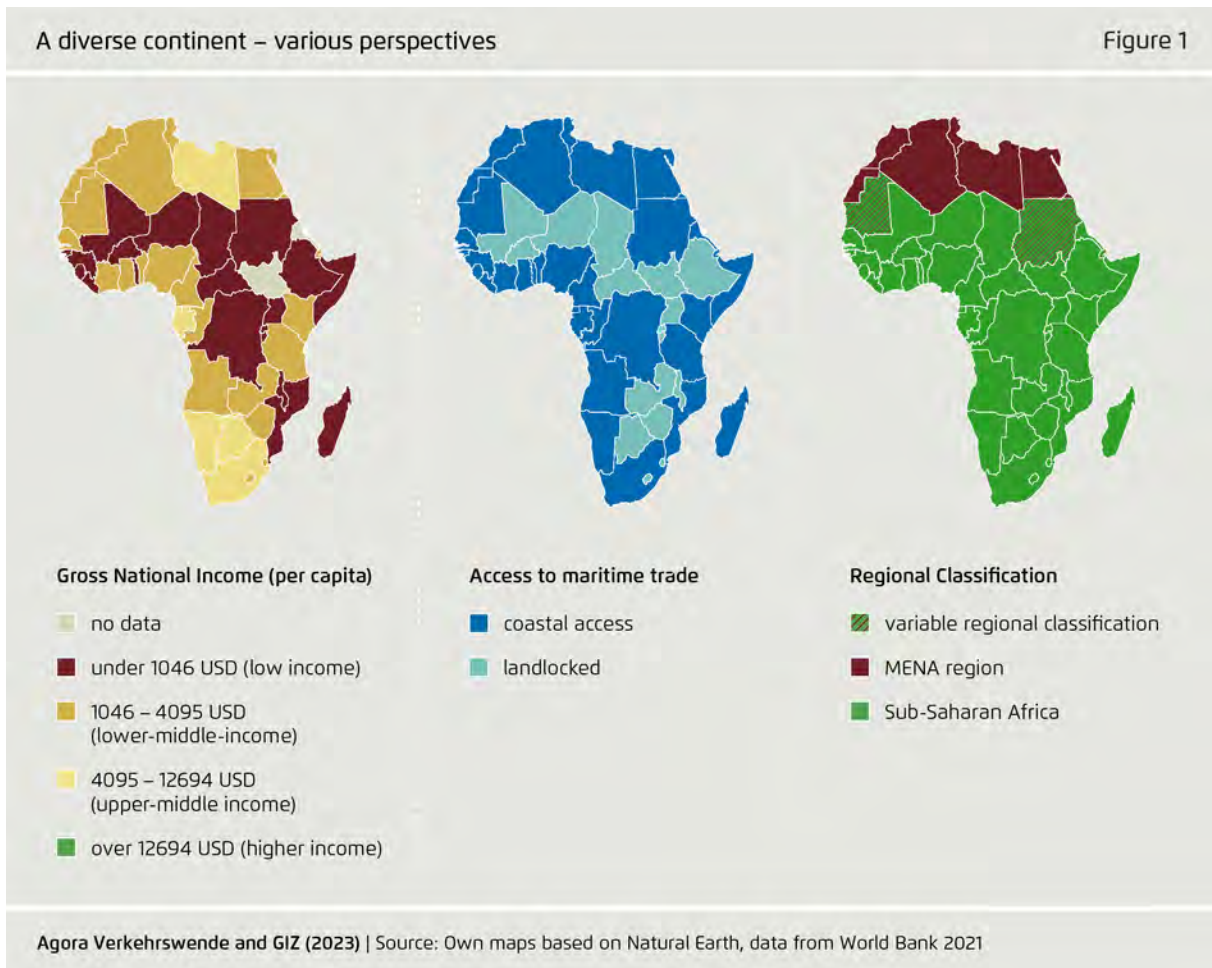
In telecommunications, African countries have already developed faster than other parts of the world: fixed-line telephony plays almost no role on the African continent; instead, many have mobile phones. Such leapfrogging has not yet occurred in the transport sector, but the prospects are good. Africa has all the raw materials needed for vehicle electrification, its potential for generating renewable electricity is immense, many cities and urban quarters have yet to be built, and the population is young and open to digital technologies – auspicious conditions for creating modern, net-zero mobility.

The terms used in the north to describe pathways to sustainable transport may not really capture what is at stake in Africa. Compared with the mass mobilization that has shaped many other regions of the world, many people travel on foot or use motor vehicles collectively. But these behaviors have grown out of poverty, not climate policy. It is a necessity and the commuting distances are often immense. The trick for African countries is to alleviate poverty without making the same transport planning mistakes of industrialized countries. What Africa needs is not a mobility revolution (Verkehrswende in German) but a modernization that is in line with the tenets of climate protection.

It is in the interest of African countries to drive this process forward. And it is imperative that they be the ones to spearhead the process on their own turf. It will be successful only if everyone participates: urban and rural populations, rich and poor, privileged and marginalized groups, the political sphere and civil society, business and industry. The governments of African countries have already taken the first steps. They have agreed on the African Union's Agenda 2063, which calls for a power system based on clean and renewable energy. They have also adopted the UN's Sustainable Development Goals (SDGs), which ensures access to affordable, reliable, sustainable, and modern energy for all (SDG 7). And they have ratified the Paris Agreement, committing themselves to make efforts "to limit the temperature increase to 1.5°C above pre-industrial levels."

4 IEA 2021a





## The North and South need to work together to modernize transport systems

The COVID pandemic and the war in Ukraine have impacted negatively both livelihoods and economy. Global crises endanger African prosperity. They hurt trade, limit goods supply, make food and petrol more expensive, and increase the cost of living. Women and children are particularly affected. The crises are making it harder for indebted countries to pay down their national debts. Finally, the accompanying erosion of multilateralism has made internationally coordinated policy for Africa more difficult.

Now more than ever, the international community has the duty to use its resources to help Africa achieve net-zero development. This is not only for the sake of poorer nations. Wealthy countries also have an interest in

decarbonizing the world's economy. Anthropogenic global warming affects us all.

But sending money to Africa is unlikely to do much unless the Global North itself steers a new course. The North's efforts so far have been inadequate, especially with regard to emissions in the transport sector. In the EU member states, for example, greenhouse gas emissions from transport have risen rather than fallen since 1990; the same has happened in the USA. This does not exactly count as role model behavior. Aligning the transport sector with the global community's climate and sustainable development goals will be no easy task. But achieving it is possible only if both North and South work together. The fight against global warming and the transition to sustainable transport is a global undertaking, and nothing less.



Picture: pixdeluxe/istock

Insight  
**01**

Net-zero mobility can ensure sustainable economic growth.

Global warming poses a serious threat to Africa's economic development. Many African countries are already among the poorest on earth; if anthropogenic climate change continues, economic conditions will deteriorate significantly, dashing millions of people's hopes for a better life. According to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), climate change not only increases the inequality of income distribution within Africa; it also reduces average per capita income.

The climate crisis stands to impact everyday life in Africa in many ways. Up to 245 million people living in low-lying coastal regions could be threatened by rising sea levels. The IPCC also expects climate change to aggravate infectious disease. It is difficult to translate climate effects directly into economic costs. It is clear, however, that the damage will be immense. Calculations by the International Renewable Energy Agency suggest that by the end of the century climate change could cost the African continent half its economic output.

## Sustainable transport can boost economic growth

It is obvious that reducing greenhouse gas emissions is crucial for basic human health and economic stability. But climate-friendly action is projected to deliver welcome economic boosts as well. According to the IPCC, if global warming can be limited to 1.5°C, per capita income will be around 5% higher in 2050 than in the case of 2°C rise. And IRENA predicts that gross domestic product will be at least six percent higher each year through 2050 if policymakers shift to a 1.5°C path instead of sticking to current targets and policies<sup>5</sup>. The effect on employment levels is also expected to be significant, with an increase of almost four percent.

The climate warming that threatens Africa today has largely been caused by North America, Europe, and China. Africa itself has contributed little; today, the continent (with 17.5% of world's population) releases less than

four percent of global energy-related emissions, about the same as Japan, a country with 126 million inhabitants. Africa's per capita emissions of CO<sub>2</sub> are under one ton, less than a quarter of the global average and only a fraction of what is emitted per capita in OECD countries. However, Africa's emissions are growing fast. Between 1990 and 2017, CO<sub>2</sub> emissions rose 123%, slower than in Asia but more than twice as fast as the global average. If this trend continues, the global community's climate goals will slip out of reach and Africa will be left particularly vulnerable. The scientific community is in agreement that the targets set by the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement can be met only if all countries – including those in Africa – introduce ambitious climate policies.

## Decoupling transport emissions from economic performance is key

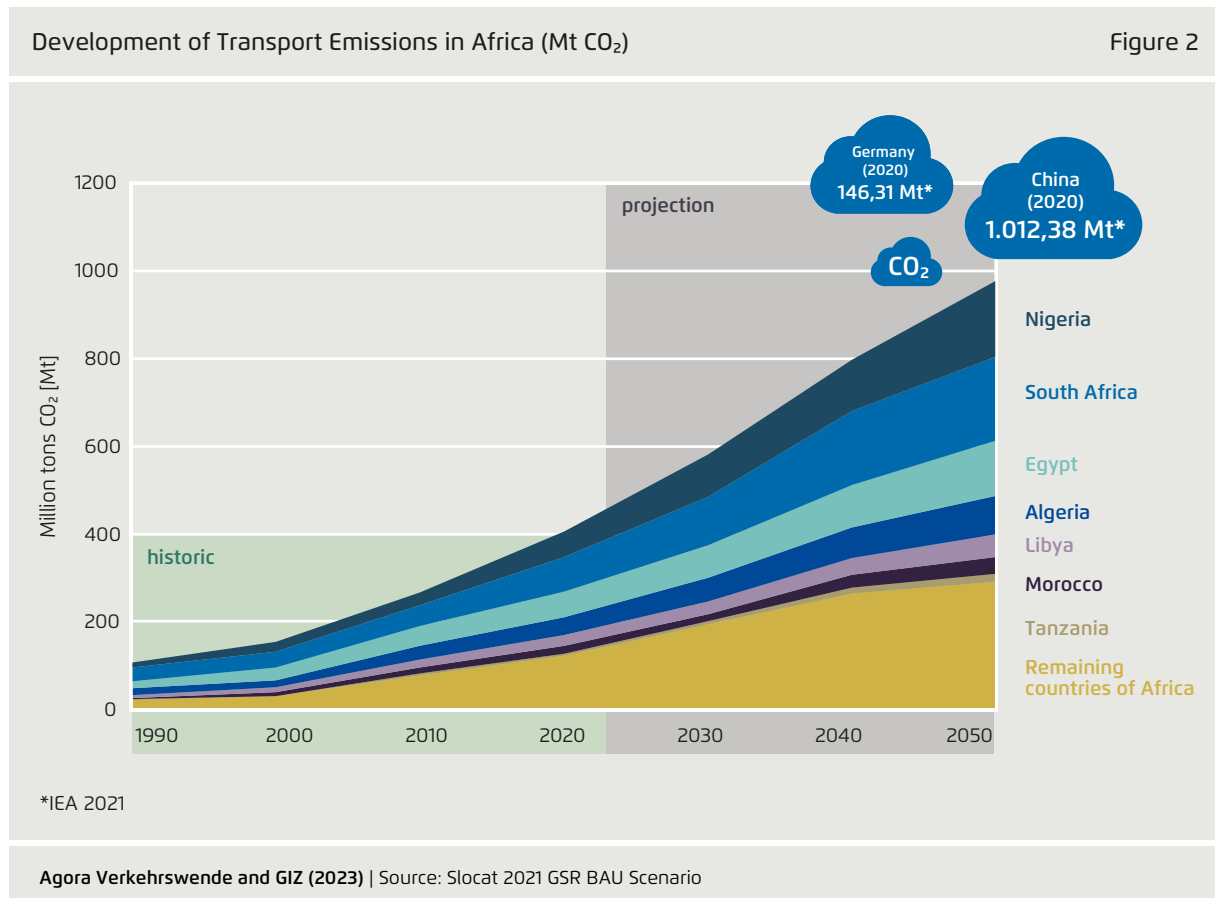
As of August 2022, 53 African countries have submitted Nationally Determined Contributions (NDCs) to the UN Framework Convention on Climate Change secretariat. If they are implemented, emissions will continue to rise until 2030, but will be around 550 million tons of CO<sub>2</sub> less than in the business-as-usual scenario. This is considerable, but not enough to put Africa on an emissions trajectory that is in line with the 1.5°C pathway.

The transport sector will play a prominent role. In Africa, it accounts for 346 million tons of CO<sub>2</sub>, almost one-third of Africa's total energy-related CO<sub>2</sub> emissions, and nearly the entire amount comes from motor vehicles. (For comparison: in 2019, India's transport emissions totaled 305 million tons and Germany's reached 157 million tons.<sup>6</sup>) Only electricity and heat generation from coal and gas-fired power plants produce a larger carbon footprint. However, road transport is catching up. Between 1990 and 2017, emissions have increased almost twice as fast as those in the power plant sector. This dynamic threatens to undermine all of the continent's climate policy ambitions.

Yet the motorization rate in Africa is still low compared with other regions of the world. On average, there are 42 cars per thousand people in Africa (though regions differ significantly), while the global average is more

5 IRENA and AfDB (2022), Renewable Energy Market Analysis: Africa and Its Regions – A Summary for Policy Makers, International Renewable Energy Agency and African Development Bank, Abu Dhabi and Abidjan.

6 IEA 2022b



than three times as high (128), and in the countries of the industrialized North it is still far higher. At the same time, trucks in African countries transport 80–90 % of goods, and freight volumes are growing. All this goes to show the enormous growth potential of the African car market, and how sharply traffic emissions will rise if no countermeasures are taken.

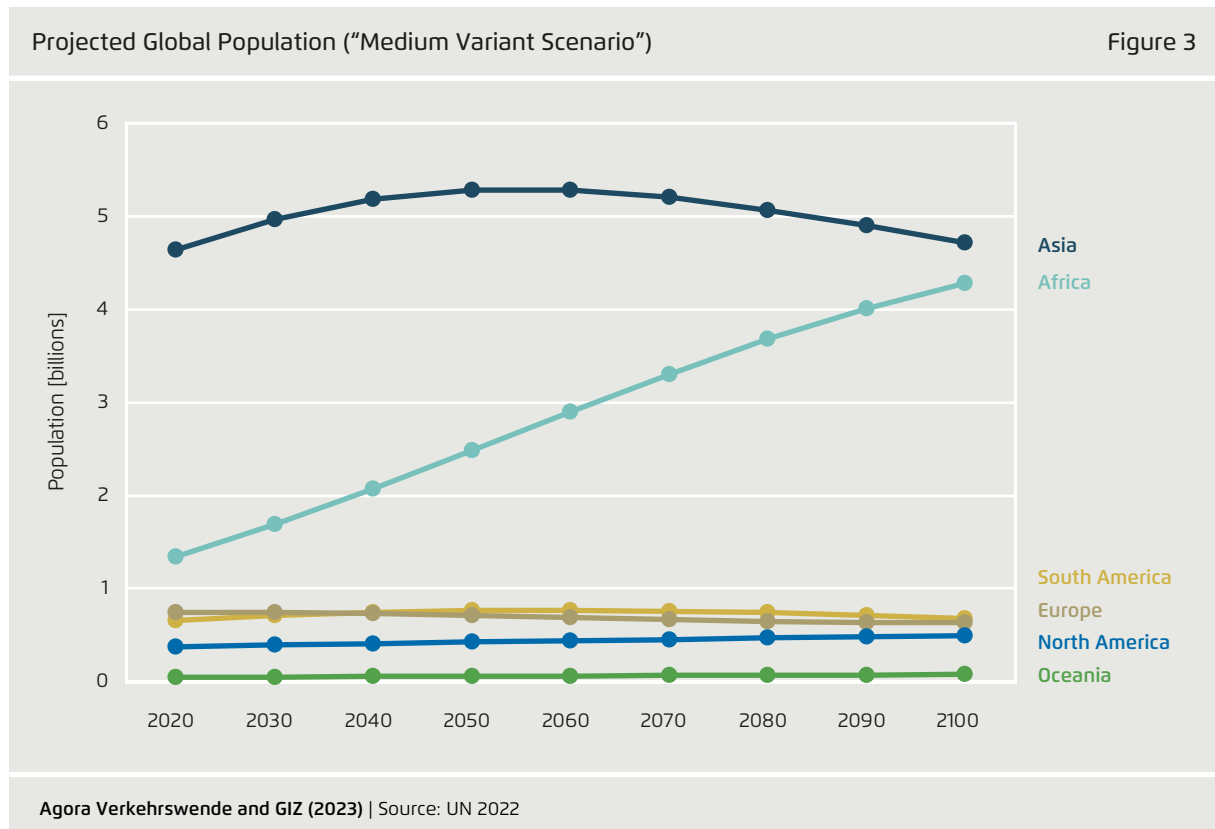
The expansion of Africa’s transport sector is being driven by two factors: population and economic development. According to current estimates, by 2050 Africa will be home to 2.5 billion people and, by the end of the century, despite declining birth rates, this number may rise to more than four billion. For this reason alone, the demand for transport will grow – increasing the potential for emissions considerably.

But population is only one factor. Empirical studies have shown that emissions also increase with rising per capita income, and Africa is no exception. The economic

development of many African countries after 2000 caused significant increases in greenhouse gas emissions in the transport sector. The COVID pandemic and the war in Ukraine has – with some exceptions – put an end to this upswing, jeopardizing many of the gains from recent years. But while future prospects may be uncertain, the need to decouple transport emissions from economic performance remains vital. Refusing to meet this challenge would mean a worse future and a lower quality of life.

### The future of transport will be shaped by policy action

GIZ and the Partnership on Sustainable Low Carbon Transport (SLOCAT) have evaluated the transport sections of the Nationally Determined Contributions and found that eight African states, including Burkina Faso, Gambia, and Liberia, have specific emission reduction targets for the transport sector. The measures identified



in the plans range from changes in the modal split to the introduction of low-carbon fuels, from electrification to improvements in transport systems. However, the countries evaluated are small and their emissions are already low. But the efforts of the small countries show that rising transport emissions are not preordained, and that a future with fewer transport emissions is possible.

Such a future will require not only the use of mature, climate-neutral drivetrain technologies. It is equally important that governments introduce policies that encourage people to avoid trips and shift to more sustainable modes of transport and that improve existing transport systems. Both approaches hold enormous opportunities. For they not only contribute to climate protection; they also prevent a growing dependence on unsustainable fossil technologies. By using Africa's rich domestic resources, they can create jobs, generate income, and propel economic development.

In order to take advantage of those opportunities, African countries need to practice foresight: Policies and mea-

sure decided today shape transport systems and emission levels and need to be coordinated with urban and infrastructure development. The countries will also need better data about their transport sectors. Only with smart planning and good informational resources will Africa be able to devise targeted policy measures that pave the way to a just and net-zero future for everyone.



Picture: GIZ GBE Uganda

## Insight 02

A successful transition to sustainable transport requires clean energy and more equitable and efficient mobility.

To date, the vast majority of world's motor vehicles is still powered by the combustion of fossil fuels, which releases harmful substances. Though technologies can counteract them somewhat, the conversion of the fuel's chemical energy into kinetic energy produces climate-warming carbon dioxide (CO<sub>2</sub>) at a fixed physical ratio: 2.37 kilograms of CO<sub>2</sub> per liter of gasoline and 2.65 kilograms of CO<sub>2</sub> per liter of diesel. In total, global transport produces around eight billion tons of CO<sub>2</sub> a year, six billion tons from road transport alone. Since 1990 CO<sub>2</sub> emissions from road transport grew faster than those of any other sector.

## Energy and transport are two sides of the same coin

The transition to sustainable transport rests on two pillars: decarbonizing the energy needed to power the transport system and making transport fairer and more efficient. The first pillar, part of the broader transition to clean energy, is a technical challenge involving the switch from petrol and diesel to clean energy for powering motor vehicles. The second pillar involves reducing energy consumption in transport without restricting mobility options while enabling simpler, safer, and faster access to services for everyone – say, by moving from high-emission to low-emission modes of transport.

Decarbonizing the energy powering the transport sector and improving mobility options both protect the climate and promise a number of other advantages. One is that they will eliminate the reliance on petroleum, whose price, which has skyrocketed due to the war in Ukraine, is highly volatile and subject to speculative influences.

In Africa, nearly all motor vehicles are powered by fossil fuels, though given the comparatively low number of vehicles on the road, they account for barely more than four percent of global transport emissions. Elsewhere, the decarbonization of road transport is slowly taking shape in the form of electric vehicles (EVs). Electric drivetrains are mature technologies, and EVs have become increasingly common in some countries. In 2021, 16.5 million EVs were sold, representing nine percent of global passenger car sales. During that year, 120,000 EVs were sold per week, as many as were sold during the whole of 2012. However, there is little information available on current EV sales specifically in Africa.

Public support for the adoption of electric vehicles depends in part on creating a nationwide charging infrastructure, but this is still lacking in many places. Building such an infrastructure is a challenge, even in industrialized nations such as Germany. This is all the more so in African countries, many of which face not only the financial and planning difficulties of developing a charging infrastructure but also the low overall levels of electricity supply. Accordingly, the addition of EVs stands to be a major challenge for African energy producers and grid operators alike.

Electrically powered vehicles produce no local emissions. Whether they are truly emission-free, however, depends on how the electricity to power the vehicles is generated. Cars, busses, trucks and motorbikes are zero-carbon when the electricity used to drive them is generated without warming the climate by using solar, wind, or hydroelectric power. The cost of generating electricity from these renewable energy technologies has fallen rapidly in recent years, which is why the International Energy Agency (IEA) has already declared solar energy the “new king of electricity supply”<sup>7</sup>. Africa in particular has 60% of the world's best solar resources<sup>8</sup> and thus enormous potential for solar power generation – an important factor in the transition to a net-zero energy system and in the electrification of its transport sector.

## Africa's vast resources hold great potential for the electrification of transport

The continent has bountiful quantities of wind as well as sunlight. Aside from a few countries, however, these natural resources have so far contributed almost nothing to the overall electricity supply. This is about to change. In its Sustainable Africa Scenario, the IEA projects that the 260 gigawatts of power plant capacity currently installed on the African continent will nearly double by 2030 – and that the bulk of the increase will be solar, wind, and hydropower plants. The change in power generation will ultimately enable the transition to clean energy in the transport sector, i.e. to meeting energy demand with zero carbon emissions. It remains to be seen

7 IEA 2020

8 IEA 2022a

how quickly this transition will occur, though. Speed is an important factor in the fight against global warming, because every molecule of carbon dioxide released will warm the earth's atmosphere for a hundred years.

In Africa, as power generation grows, electricity demand will too – not just in the transport sector, but in all areas of the economy. For now, however, the amount of kilowatt hours generated from sunlight, wind, and water is in short supply, so it must be used efficiently. Hence, measures must be taken to limit energy demand in the transport sector without restricting people's mobility options.

IT and communication technologies will be crucial for implementing these measures. With their help, it will be possible to expand the range of transport options and build networks of different transport modes for multi-modal travel. This, in turn, will give people the opportunity to organize their own mobility more efficiently. Transport costs will be reduced if routes are bundled – and if in the future shorter distances can be covered on foot or by bicycle more safely and comfortably than they can be today.

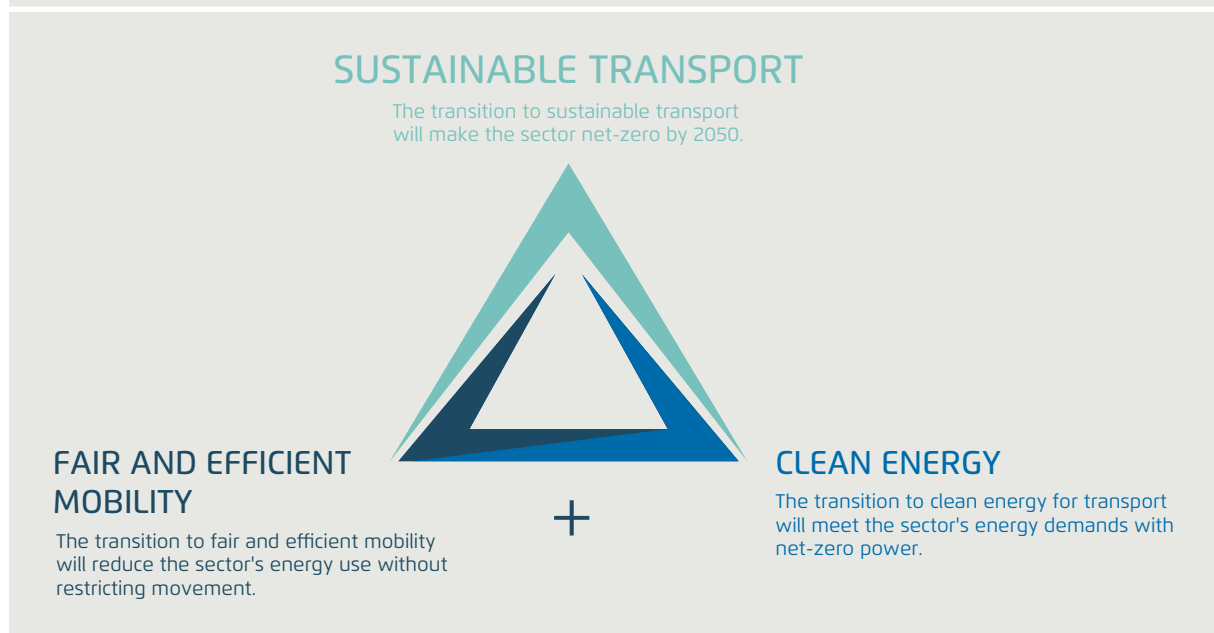
## Sound policy frameworks make transformative action possible

All of this depends on a resolute political framework, one that aims to strengthen public transport, enable new transport services, and improve the transport infrastructure, including the possibilities for active mobility. Ideally, the political framework will focus on urban development together with its transport infrastructure plans. Transport costs can be minimized if people live near where they work so that distances are easier to overcome. Besides improving transport and protecting the environment, the transition to sustainable mobility will be more inclusive with regard to disadvantaged population groups.

Each individual African country, region, and city must find its own way of designing transport systems, though international experience can help. According to the UNFCCC, the countries of the North, the greatest contributors to global warming, have a duty under international law to help other countries, the Global South in particular, "better cope with the problems of climate change."

The geometry of the transport transformation

Figure 4



Agora Verkehrswende and GIZ (2023) | Source: Agora Verkehrswende 2017







Picture: TLF Images/shutterstock

Insight  
**03**

Creating fairer and more efficient mobility is the key to creating healthy, sustainable, and livable cities.

Africa is the world's least urbanized continent, but its cities have the highest levels of annual growth. Africa's urban population is expected to double by mid-century, from nearly half a billion people to more than one billion. More than half of the urban population lives in small- and medium-sized cities with fewer than 500,000 inhabitants; these secondary cities are experiencing the fastest rates of growth. However, new metropolitan regions and megacities with more than 10 million inhabitants are also emerging. By 2040, these are expected to include Cairo, Kinshasa, Lagos, Johannesburg, Luanda, Dar es Salaam, Nairobi, and Abidjan<sup>9</sup>.

African cities are expanding outward. In many places, unplanned, informal settlements are emerging in the surrounding countryside, giving rise to sprawling and poorly connected communities. In these places, providing basic infrastructure is costly, and public mass transport systems are difficult to establish, despite the high mobility demands necessitated by the new settlements' locations.

## Managing urban growth is a prerequisite for sustainable mobility

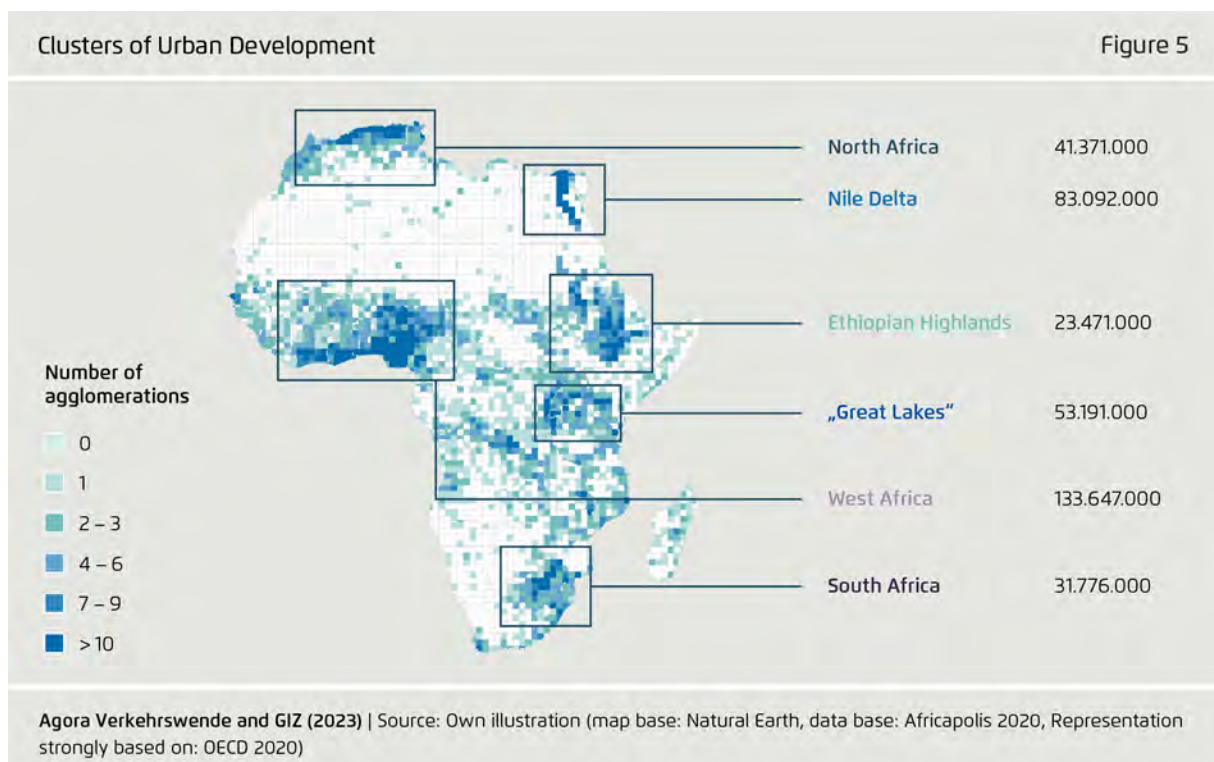
According to the UN, two-thirds of the urban development Africa will have in 2050 does not yet exist. This means that urban development decisions can still avoid negative lock-ins such as car-centric planning. Today, 80% of urban residents do not own a motor vehicle, but motor traffic is nevertheless growing faster than the population<sup>10</sup> because of high transport demand and the lack of appealing alternatives. The negative effects of increased motor traffic are already visible in many African cities. For example, road traffic is one of the main sources of air pollution in Africa's 21 fastest-growing cities, causing 110,000 premature deaths per year as of 2018<sup>11</sup>.

Shaping the powerful effects of urbanization and promoting climate action, poverty reduction, economic development, and social participation at the local level represent an enormous challenge, but also a historic opportunity.

9 World Cities Report 2022 & World Urbanization Prospects 2018

10 SSATP 2022

11 The Conversation 2022



Shaping the development of rapidly growing cities is extremely challenging, especially as most urban development in Africa is informal. Its dynamic and often chaotic urbanization goes hand in hand with weak governance, large social disparities, and precarious environmental conditions. Many urban settlements are fragmented, planners are not adequately trained by the government, institutions to address urban challenges are weak, and reliable data usually does not exist. A study by the IMF found that nowhere else on earth are urban governments endowed with as little fiscal autonomy as in African cities. For this reason alone, the scope for problem-solving is limited. Governments in Africa spend about \$45 billion annually on urban infrastructure; the estimated needed investment is \$92 billion<sup>12</sup>.

12 ICA 2018

## Strengthening rural mobility is as important as policy action in cities

The growth of African cities is due to both high birth rates and migration from rural areas. Many come because of job opportunities; many other come because of lack of prospects elsewhere. Climate change, resource scarcity, land grabbing, and policy neglect are some of the reasons that force people to resettle in cities. In many places in Africa, for example, people are leaving agricultural activities in favor of informal service sector jobs in cities.

Strengthening rural regions could make urbanization more manageable. Here, too, transport policy stands to play a role: more mobility options would make it easier for smallholders to take their products to the market, get to school, or to visit health clinics. For example, a start-up from Zimbabwe called Mobility for Africa has developed a business equipping smallholder communities with electric rickshaws ("hamba"). The vehicles use exchangeable batteries, which can also be utilized for other purposes, and draw their energy from solar-powered mini-grids, allowing drivers to use the sun to reach their destinations. Currently, rural Africa has very

## Improvements for pedestrians means improvements for the majority of Africa's road users

Walking, the most environmentally friendly form of transport, is predominant in most African cities. In Dakar, for example, 70% of all journeys are made on foot<sup>13</sup>. This is not an expression of pronounced environmental awareness, however; it is primarily due to social inequalities. Using buses and other forms of motorized transit each day would cost the poorest 20% of households in African cities an average of 30 to 50% of their incomes.

For the most part, walking in Africa is not a pleasant experience. Nine out of ten roads on which pedestrians travel do not have safe and barrier-free footpaths. Nowhere are as many people killed in road traffic, and nowhere is the proportion of pedestrians among those killed as high<sup>14</sup>.

Improving and expanding the pedestrian infrastructure is a great opportunity to encourage people to forgo motor vehicles even if they can afford to take them. Such a shift of paradigm in urban and transport planning would also call for changed division of new and existing road space to ensure that pedestrians, cyclists, wheelchair users, etc. have the same right to public space as motorists.

13 MobiliseYourCity 2022 a

14 WHO 2022

diverse forms of transport, but their costs are high and their availability is insufficient and poorly coordinated.

### **Integrated urban planning can prioritize active mobility, public transport, and multimodal systems**

Coordinated urban development, though extremely difficult, is needed to protect cities from the climate crisis and from the threats posed by extreme heat, heavy rain, storms, and rising sea levels. At the same time, it must develop transport systems that are good for the environment and the climate and that can withstand more frequent extreme weather events. But planners in Africa often lack even the most elementary data about their cities and regions. Plus, there is often a lack of financial resources and specialist staff to plan and build climate-resilient infrastructure.

As an idea, a “vision of the African city of tomorrow” may be appealing, but it does not do justice to the diversity of African cities. Rather, multiple visions are needed, adapted to local contexts and involving local actors. There are already insights and experiences that can help create transport systems in African cities that are sustainable and inclusive. The MobiliseYourCity Partnership, for example, has proposed approaches and methods to guide sustainable mobility planning for local decision-makers. Thirty-two African cities are involved in the partnership. Local initiatives and pilot projects such as Ghana’s CargoBikesAfrica have already demonstrated the role that shared mobility, cycling, and intelligent solutions can play in African cities; they provide important inspiration for the transition to sustainable urban transport.

### **As African cities expand, they can be built for people, not for cars**

The move away from car-centric planning can slow and possibly reverse the motorization of urban transport, provided that the distances between places of living and working and other aspects of everyday life remain accessible on foot or by bicycle. For more distant destinations, the expansion of public transport systems will be unavoidable for creating a comfortable and reliable alternative to car use.

If cities in Africa can coordinate urban development and spatial planning, if they can preserve active mobility and make it safer while at the same time expanding and improving public transport systems, their inhabitants will reap the benefits. But the introduction of fair and climate-friendly transport will require an alliance of actors in policy-making, administration, the private sector, research, and media to rally broad public support. In particular, living space must be planned jointly with the many people in African cities who reside in informal settlements. Their participation is crucial for the long-term success of the transition to sustainable transport.



Picture: Carlos Felipe Pardo/flickr

## Insight 04

The paratransit sector is essential for the sustainable design of urban and rural mobility services.

In the debate about modern mobility, certain buzz words appear again and again. Ride-hailing – calling a taxi via smartphone app – is one of them. In some regions of the world, ride-hailing services have already become a billion-dollar business. The providers are also active in African cities, and their services are often considered much safer and more reliable than existing taxis. The business is driven by a social megatrend of the urban middle class: increasingly dynamic and variable patterns of travel behavior.

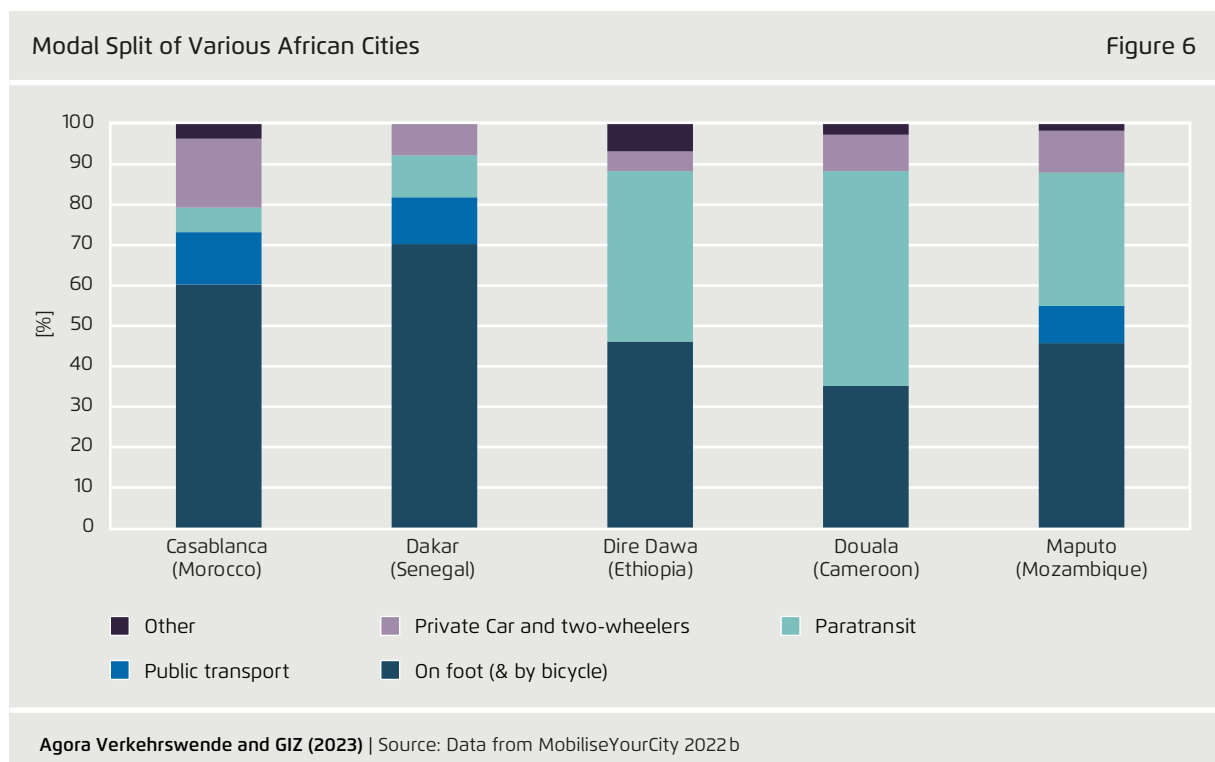
While in Europe and the US policy-makers are still working to ensure that the new driving services are used by multiple passengers at once, in order to reduce vehicle kilometers and resource consumption, share taxis in the form of minibuses have long been available in many African cities, though their presence is due more to a lack of alternatives and income than a desire to help the climate. In Kenya these minibuses are called matatus; in South Africa, taxis; in Ghana, tro-tros; in Côte d'Ivoire, gbakas; in Senegal, cars rapides. They all fall under what is known as paratransit, a term coined in North America for flexible transportation services that mostly respond to demand instead of following fixed routes and schedules.

### Paratransit secures mobility and income in many African regions but brings many challenges as well

In addition to minibuses, paratransit vehicles include passenger cars, mopeds, rickshaws (tricycles), and bicycles. In Africa, the paratransit business is part of the informal sector. There is no continent-wide data on the number of journeys, passengers, and the scope and development of the business; such data is available only for individual cities. While scheduled public buses operate in many African cities, in some places, paratransit plays an important role. For example, in Kampala, Uganda, a fleet of 16,000 minibuses carried more than 80% of all commuters in 2015<sup>15</sup>. The paratransit share in public transport is 58% in Cape Town, 86% in Accra, and 87% in Nairobi<sup>16</sup>. Even though COVID has temporarily hurt the paratransit business, it remains the backbone of motor transport in African cities.

15 Ndibatya & Booysen 2020

16 Welle 2018



The great importance that private transport services have achieved is due in part to the fact that they emerged in response to a public transport shortage. But informal paratransit services also have their downsides. These include poor road safety and a high risk of accidents, as well as low levels of comfort, which also limit accessibility for older people or for people with limited mobility. A downside of informal systems is that, unlike formal transport systems such as scheduled buses, Bus Rapid Transit (BRT), or light rail lines, they merely respond to urban growth rather than controlling and structuring it. Often, routes with low demand are serviced rarely if ever because of their economic inefficiency. In addition, it is not uncommon for drivers pressured by job insecurity and fierce competition to work more than 12 hours a day.

## Paratransit provides thousands of jobs

Though the working conditions are mostly very poor, paratransit still provides jobs and income for millions of people. In Kampala alone, an estimated 100,000 people are employed in paratransit, and in Lagos the total is as high as 500,000<sup>17</sup>. There is no doubt that the paratransit sector helps alleviate poverty, and this fact often plays a role in decisions on whether to introduce Bus Rapid Transport (BRT) systems. Though BRTs provide public transport, they have an impact on paratransit jobs and have been linked to larger companies. For example, a study in Dakar<sup>18</sup> warns that the introduction of BRT could lead to the loss of five to ten thousand jobs in the informal sector.

17 Kumar et. al 2021

18 ITF 2021

If the transport systems of African cities are to improve, policy-makers and government officials will need to build on these experiences and work closely with paratransit stakeholders. There is no doubt that formal mass transit systems are needed in many African cities. Especially in high volume corridors these are the most efficient options and can operate profitably. However, combined with paratransit they may look different from highly subsidized public transport systems in Europe.

## Future mobility systems can build on experiences with paratransit

But minibuses, motorcycle taxis, and the like will not simply be abolished. On the contrary, they will probably continue to play a key role in the transport system of practically every African city and will continue to ensure that there are mobility options in urban and rural areas. But in order to combat their various ills and to integrate informal services into strategic transport planning, local governments must introduce stricter regulations for the sector, including fixed stops, better standards for road and occupational safety, and more careful planning and licensing. This will increase convenience and prevent the siphoning off customers from profitable routes in formal public transport systems. Introducing these regulations will be a challenge for city authorities in view of the bargaining power of the thousands of paratransit operators and the consequences of mass protests. Yet Africa's high penetration of mobile phones and increasing number of smartphones will make it easier for authorities and paratransit providers to improve their services.

## Electrification can make paratransit fleets more environmentally friendly

There is no precise knowledge of the extent to which motorized paratransit contributes to urban air pollution and greenhouse gas emissions. Nevertheless, it is clear that the amounts involved are considerable. Although the first electric versions are just coming onto the market in South Africa and e-matatus are already on the road in Kenya, most vehicles in Africa's informal sectors are powered by diesel engines. They are old, poorly maintained, spend long hours in traffic jams, and generate large amounts of particulate matter. In view of the large number of old vehicles, there are already discussions about whether retrofitting them with hybrid, electric, or more efficient drivetrains is worthwhile.



Experienced approaches for building better paratransit systems already exist<sup>19</sup>. One element of those approaches is formalization. For example, local governments could create contracts with operators that define pricing and other regulations, ensuring profitability for paratransit businesses and convenience and reliability for passengers. Digital technologies such as route mapping and online payment and ticketing are another potential path to improvement. A third consists of subsidies for the informal transport sector so that paratransit operators can modernize and electrify their vehicles. Finally, a growing number of start-ups are currently developing a raft of innovative, high-quality services to improve paratransit.

The future of formal mass public transit and paratransit is likely to bring changes both large and small. Their implementation will require that policy-makers see paratransit as an ally, embracing the informal sector's challenges and opportunities for creating sustainable transport systems.

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19 For a summary, see the paratransit toolkit by the Mobilise-YourCity Partnership 2021.



Picture: ViewApart/istock

Insight  
**05**

Digital data can ensure that the transition to sustainable transport keeps pace with dynamic development in Africa.

In many cities and metropolitan areas in Africa, para-transit is the backbone of mobility. But who uses para-transit services, and when, and what routes the vehicles serve, where they stop, and their frequency, often remain shrouded in mystery. This goes for city planners as well as for passengers. It is similar in urban and long-haul logistics, where goods need to be transported by hundreds of small or medium sized logistic companies. Decision-makers simply don't have enough information about the mobility needs of city dwellers and local companies. This can result in bad investments.

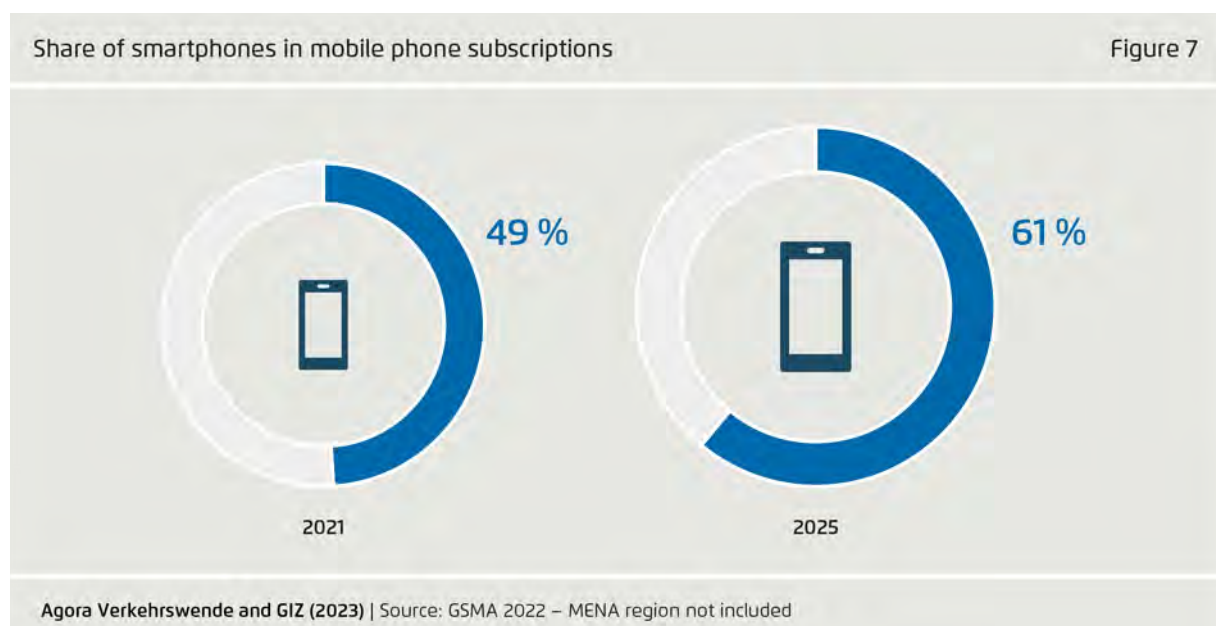
In their attempt to get a handle on urban mobility, cities are building expensive express bus and rapid transit systems. These systems serve as the main arteries, bundling urban traffic and structuring urban growth, while informal minibuses and motorcycle taxis are reserved for the areas in between and other lower-demand routes. For these efforts to work, however, the two tiers must be coordinated. The better the understanding of the mobility needs, the easier it is to find the right solutions. While countries in the Global North are investing huge resources in data collection, African cities often struggle to collect such data. The reason for this is not only because of high costs for surveys but also because of informal urban development and rapid growth, which means that data is already outdated by the time it becomes available to planners..

## Digital data can support evidence-based decision-making and planning

If policy-makers better understood movement patterns, they could avoid such errors. The traditional approach to obtain this data is to count vehicles, conduct surveys, and keep route diaries. Smartphones have transformed the process. Mobile tracking provides data that is more comprehensive and more specific, which leads to better traffic planning. More than 80% of Africa's urban areas have 4G network coverage. And despite the fact that mobile internet usage in Africa requires a significantly higher income share than in many developed countries in the North, 41% of residents on the African continent have an active mobile broadband connection<sup>20</sup>. There are large regional differences, however – between urban and rural areas, between population strata, and between countries.

Of course, digital data cannot completely replace traditional approaches, especially if policy-makers want to take into account the needs of those who do not use smartphones. Indeed, the proportion of people who use the internet in Africa is lower than it is anywhere else. Mobile data can thus add new layers and perspectives but does not offer one-stop solutions.

20 ITU 2021



In fact, mobile phones and smartphones can do more than track and manage personal mobility. They can be used to optimize the routing of trucks and delivery vehicles, to localize accident blackspots, to exchange information about general traffic conditions, to provide real-time traffic information, and to develop traffic plans. A few initiatives have already taken the first steps. In 2013, a Kenyan-American research group created Digital Matatus, the continent's first digital map of a minibus network, for the city of Nairobi. The start-up WhereIsMyTransport, founded in Cape Town in 2015, now collects data from more than 50 cities in the Global South, including some in Africa. The information it gathers can be used by transport planners to make smarter investment decisions. DigitalTransport4Africa (DT4A) brings together findings from mapping projects and provides resources and networking opportunities for participating organizations. DT4A also offers training for municipalities and transport authorities so that collected data can be analyzed and used for planning purposes.

## The expansion of transport infrastructure brings opportunities for leapfrogging in data collection technologies

GPS-enabled smartphones are just one technology for data collection. Sensors on vehicles and drones can record road conditions in real time. Similarly, existing infrastructure can be equipped with cameras and sensors, which can be used, say, to count vehicles. Other useful sources of data include electronic payment systems, which are already widespread in some countries, and volunteered geographic information (VGI). Even space technology could be used, because the analysis of satellite images provides insights into traffic conditions<sup>21</sup>. All these sources enable data-driven urban planning and intelligent transport systems.

A 2020 World Bank report<sup>22</sup> on the introduction of data-driven transport planning in Dar es Salaam identifies the opportunities it offers – as well as the political and institutional preconditions that must be met if it is to be suc-

cessful. A particularly important element is finding and training local personnel with the skills needed to evaluate and interpret the collected data. With the coming infrastructure expansion and advancing urbanization, there is the opportunity to take data collection technologies into account at the early planning stages.

Of course, data must not only be collected; it must also be used. This requires city administration experts whose mission is to generate knowledge and create capacities for processing, storing, and updating data in accordance with uniform standards. Fortunately, Africa's young population is tech-savvy and large – almost 60% are under the age of 25<sup>23</sup>. The digital transformation in the transport sector stands not only to provide access to new data, but also to create jobs and become a significant factor in the economy.

Another good example for the benefits of using data: Founded back in 2018, the Nigerian start-up Kobo360 uses artificial intelligence to connect cargo owners, truck owners, drivers, and cargo receivers in order to ensure the optimal delivery of goods and reduce inefficiencies in freight transport. Two years ago, the company launched a program aimed at creating secure cold chains in transport. The Food and Agriculture Organization (FAO) estimates that food worth four billion dollars a year is rendered unusable in Africa due to deficiencies in cold-chain logistics and to long waiting times at border crossings (Sub-Saharan Africa).

21 For instance, the Transformative Urban Mobility Initiative is currently exploring the use of satellite data to support urban mobility planning.

22 World Bank 2020 a

23 Brown 2020

## **Open data approaches will enable the greatest possible benefit from digital data**

As African cities begin to collect traffic data, two other issues will become relevant: data privacy and data accessibility. People's sensitivity to data protection can vary from region to region and from country to country, so the level of personal data privacy must be determined locally. As a rule, digital traffic data is most useful when it is available to everyone in aggregated form. Big data-generating companies from the telecommunications industry are the ideal partners for transport planners and transport authorities. Start-ups can also use the data to develop and expand mobility-related services. Open data laws can regulate the disclosure of data in uniform standards and ensure its digital availability. At any rate, the ways public and private actors use digital data in the future will be crucial for the mobility of people and goods.



Picture: Carlos Felipe Pardo/flickr

Insight  
**06**

Social justice is a basic precondition for sustainable transport.

It is certainly true that smartphones, the Internet, and data collection are important for Africa's development and for the development of transport systems in African cities. But the surrounding debates overlook the acute needs of hundreds of millions of poverty-stricken people on the continent. Poverty limits their mobility – and their limited mobility threatens to perpetuate their poverty.

Poverty remains the biggest challenge facing countries in Africa. There has been some progress: the proportion of the population living on less than \$1.90 per day declined from 40% in 2010 to 34% in 2019. Positive trends over this period can also be observed for the number of households living on less than \$3.20 a day (from 63% to 59%) and on less than \$5.50 a day (from 83% to 80%). However, the poverty rate is declining more slowly than the population is growing; accordingly, there are actually 37 million more poor people on the continent today than in 2010. According to current data, 490 million people in Africa today live on less than \$1.90 a day<sup>24</sup>.

### The everyday significance of poverty is also reflected in mobility

In places where poverty persists, climate concerns take a back seat to the daily struggle for survival. As the IPCC points out in its Sixth Assessment Report, climate measures planned in concert with poverty reduction efforts meet with greater public acceptance, are more effective, and produce more lasting results.

Motorized transport – even in the informal sector – is simply unaffordable for the very poor. In urban regions, where transport is available, many lack the money to pay for it. The poorest 20% of households in African cities would have to spend an average of 30 to 50% of their income to use motorized transit on a daily basis<sup>25</sup>. The shortage of affordable transport in Africa's sprawling cities enormously limits people's range of movement, and makes it difficult to secure formal employment: no transport, no work, no regular income. Better transport is not a sufficient condition for alleviating poverty, but it is a necessary one.

Although this applies to both urban and rural inhabitants, the majority of Africa's population still lives in rural areas. Their mobility is a valuable commodity. It is essential for meeting basic human needs such as getting to school or reaching public services and infrastructures. Villagers without access to a vehicle are scarcely able to handle everyday challenges without immense expenditures of time – especially as only one in three rural dwellers lives within two kilometers of the nearest all-season road.

### Sustainable transport solutions will need to take various forms of inequality into account

In addition to the widespread poverty in many African countries, income disparities within and between African countries remain large. In Africa's richest country, the Seychelles, per capita income is more than 40 times higher than in the poorest country, Burundi. And while in Algeria income is distributed fairly evenly, roughly equivalent to that of Denmark or Austria, in South Africa, Namibia, and Angola the Gini index, a measure of income inequality, is higher than in any industrialized country in the Northern Hemisphere<sup>26</sup>. According to UNCTAD, economic growth over the past two decades has been "inclusive" in 17 African countries, that is, it has reduced both poverty and inequality. In 18 African countries, by contrast, poverty has fallen but inequality has increased. In 14 African countries, growth has reduced neither poverty nor inequality.

Furthermore, the differences between urban and rural areas are often much bigger than in the Global North. In cases where infrastructure such as all-weather roads, grid connected electricity and transport services are not available, other solutions are needed than in big cities. In the search for practicable and affordable mobility solutions, existing examples can be useful. For instance, BikeAid and World Bicycle Relief provide bikes to improve the daily lives of the population and increase productivity, especially in rural areas. CargoBikesAfrica is a bike-sharing company that offers electrically powered cargo bicycles optimized for the African market. Its business model is designed to reach population groups

24 UNCTAD 2021

25 World Bank 2016

26 World Bank 2016

for whom whether on account of financial or social reasons, buying a bike or obtaining a driver's license is out of the question.

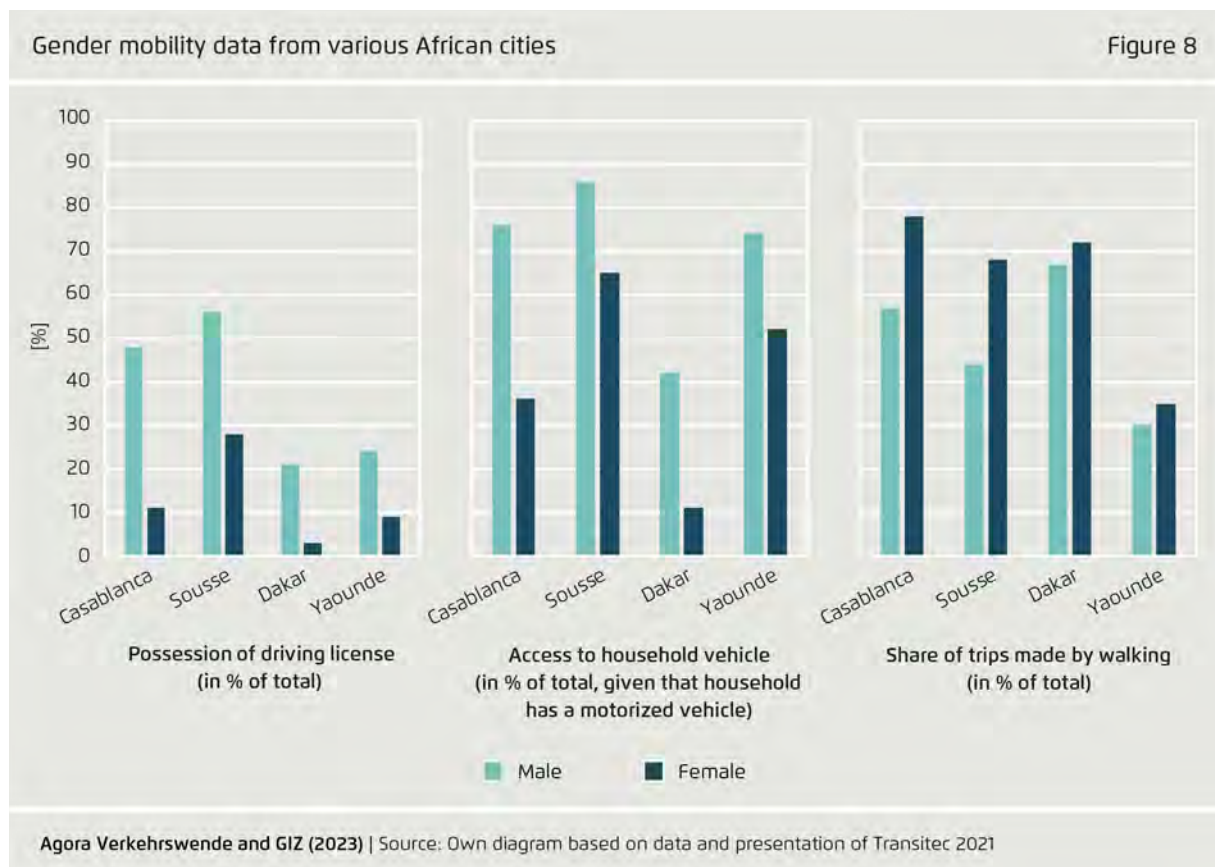
### Gender-sensitive decision-making will ensure a just transition in the transport sector

Like other continents, Africa has large differences in gender equality. According to the World Economic Forum's Gender Gap Report (2022)<sup>27</sup>, gender equality in Rwanda is exemplary, even in global comparison, while the Democratic Republic of Congo occupies one of the last places in the ranking. All in all, however, the gender gap in Sub-Saharan Africa is close to the global average, which says more about the disadvantages of women around the world than about the achievements of African countries.

Studies on gender-related differences in African mobility have found that women often have fewer financial resources available for transport, they are more likely to experience harassment and violence, and they tend to travel shorter distances or are less mobile overall. The greatest inequality is evident when looking at access to motor vehicles. Not only are women two to seven times more likely than men not to have a driver's license; they are significantly less likely to have access to a car or a motorcycle even when they live in households where such vehicles are available<sup>28</sup>. Understanding and considering such gender-related differences in transport planning is a prerequisite to create equal access to mobility for all genders. Representation is another one - women should not only be taken into account in decision-making processes but also actively participate in them as decision-makers and leaders.

27 WEF 2022

28 Transitec 2021





Though the problems in the transport sector mostly originate elsewhere, the structures of transport systems tend to exacerbate them. In many African countries, transport restricts the social participation of the elderly, of children, of people with disabilities, and of ethnic or religious minorities. Not only is their access to transport limited, but moving around in public spaces can be unsafe and sometimes dangerous.

## Participation can lay the foundation for the inclusion of everyone

Nevertheless, cars and car-friendly cities are not the solution to these problems. Using cars causes congestion and accidents, noise, air pollution, and greenhouse gas emissions. In any case, very few people can afford a car; for most, they are only a source of harm. That is why smart transport planning and policy must focus on the needs of the poor and low-income majority. Studies have shown that most decision-makers do not adequately understand the complex interactions of residents in informal settlements, and hence do not consider their needs in transport planning. This may be due to outdated paradigms, which even in the Global North continue to shape policy.

Lack of data and related misperceptions certainly also play a role, as do patronage systems that prioritize the mobility needs of the upper and middle classes, the men among them in particular. What is needed is not only new training but institutionalized participation in transport planning, a process in which people from all levels of society can articulate and discuss their mobility needs.

The transition to sustainable transport will spur economic development. This alone will not reduce poverty and social injustice. Properly conceived, however, the transition can benefit much of society, whether in Africa or elsewhere.



Picture: Ampersand/[www.ampersand.solar](http://www.ampersand.solar)

Insight  
**07**

Electric transport is the most efficient way for Africa to shed its dependence on fossil fuels and achieve net-zero mobility.

Access to electricity varies enormously across Africa: in North Africa, almost everyone is connected to the electricity grid; in sub-Saharan countries, by contrast, many communities have no electricity at all. And for those who do have access to electricity, the power supply is often unreliable. It may therefore seem bold to claim that the future of transport in Africa lies with electric vehicles. But Africa not only has enormous potential to generate climate-friendly electricity from the sun, wind, and water; it also contains large quantities of the resources needed for the production of traction batteries and for the use of hydrogen technologies. To date, both of these potentials have remained largely untapped.

Currently, several African countries extract and export petroleum. These are led by Nigeria, Libya, Angola, and Algeria. Other African countries have to import oil at a high cost, which they use mostly to power motor vehicles. Oil production is associated with high levels of environmental pollution, and the combustion of petroleum products releases air pollution and greenhouse gases. Yet, in the long term, the economic prospects of the oil industry are dim – provided that countries make good on their Paris climate commitments. It is becoming clearer by the day that the backbone of the future transport system will not be oil, but renewable electricity.

## Africa has vast potential for renewable energy and battery resources

Sixty percent of the world's best solar sites are located in Africa. It is estimated that current technology can generate one thousand times more renewable electricity than will be needed on the entire continent in 2040. The potential is so large that it can power not only those 600 million people who do not have access to electricity today but also the growing energy demanded by businesses, households, and transport, with enough left off for export.

What makes Africa's energy future even more promising is the fact that some of the raw materials central to battery production are particularly abundant in Africa. Both the generation of renewable electricity and the development and processing of the resources needed for battery production (see Insight 8) hold great potential for local value creation. If the future of motorized transport in Africa is to be electric, a reliable power supply must be established.

The number of households and businesses that can be supplied with electricity in the future and the options for making the power supply more reliable vary from country to country. According to World Bank calculations, investments of 40 billion dollars per year would be needed to provide more people with electricity, to make the power supply more reliable, and to add to the grid growing amounts of variable supply from wind and solar installations. However, this does not mean that in the future every village and farm will have to draw power from a supra-regional grid. On the contrary, according to a World Bank analysis, connecting to an existing grid makes sense only for about 45% of electricity consumers; for the rest, a mini-grid or a stand-alone (off-grid) power supply is more advantageous. These alternative power supplies are made possible by photovoltaic (PV) systems, whose prices have fallen substantially in recent years. Electricity from PV is now cheaper than electricity from any other source.

Electricity makes people's everyday lives much easier. It provides light and a clean source of energy for cooking, and it can be used to operate sewing machines and charge mobile phones. The fact that electricity can also be used to power electric vehicles is an important additional benefit, though in order of importance it comes after those essential for survival. If electric transport is to take hold in Africa, more electricity and more electrical infrastructure are indispensable. Green hydrogen could also play a role, but its production requires high levels of energy and large-scale output is still a long way off.

## Climate-neutral drivetrain technologies

There are different approaches for using renewable electricity in transport. The direct use of electricity in battery-electric vehicles (from two- and three-wheelers to cars, trucks, and buses) is the most energy-efficient option; however, it requires grids and charging stations. Where such infrastructure is lacking, hydrogen and synthetic fuels produced from hydrogen are possible alternatives.

Hydrogen is a form of stored electricity that can be converted back into electricity in fuel cells. However, the production of hydrogen is very energy-intensive and requires its own infrastructure. Accordingly, experts

argue that battery-electric vehicles have a clear advantage over hydrogen, even in industrialized societies such as Europe, the US, and China. It is thus unlikely that Africa will seek to build out hydrogen production for vehicle use.

Another option are synthetic fuels, also known as synfuels, electrofuels, or PtL, which are produced from a combination of hydrogen and carbon molecules. Unlike hydrogen, commercial-scale synthetic fuel for vehicles can use the existing filling station infrastructure. Provided that renewable electricity is used for production, synthetic fuels would make conventional vehicles nearly net-zero. However, the production of synfuel is even more energy-intensive than that of hydrogen; it takes 2–3 times as much green electricity as hydrogen and 7–10 times as much green electricity as batteries to propel a vehicle a given distance.

For some industrial applications, such as fertilizers, aviation, or maritime shipping (see Insight 9), hydrogen and synfuels are currently the only viable option for decarbonization. In these areas, there is no alternative but to accept the additional energy needed for production. For the sake of energy efficiency, however, it is important that direct electricity be used whenever possible. Even if hydrogen and synfuel production ramp up significantly in Africa, it would be economically wasteful to use them for road transport.

## Two- and three-wheelers are leading the way – other vehicle types will follow

When it comes to the electrification of transport in Africa, battery-electric mopeds and three-wheelers are already leading the way. Their small batteries can be charged on mini-grids, or quickly swapped out for even faster charging times. Compared with conventional mopeds that have combustion engines, electric versions are more expensive, but the lower energy, maintenance, and repair costs offset the higher initial price tag. After just five years, the total cost of ownership (TCO) is lower than that of conventional two-wheelers. This makes small electric vehicles lucrative for commercial use as well. Various start-ups in Africa have already entered the market, which is large and growing rapidly, and soon they will be everywhere. The United Nations Environment Programme (UNEP) also supports countries in the introduction of electric two- and three-wheelers.

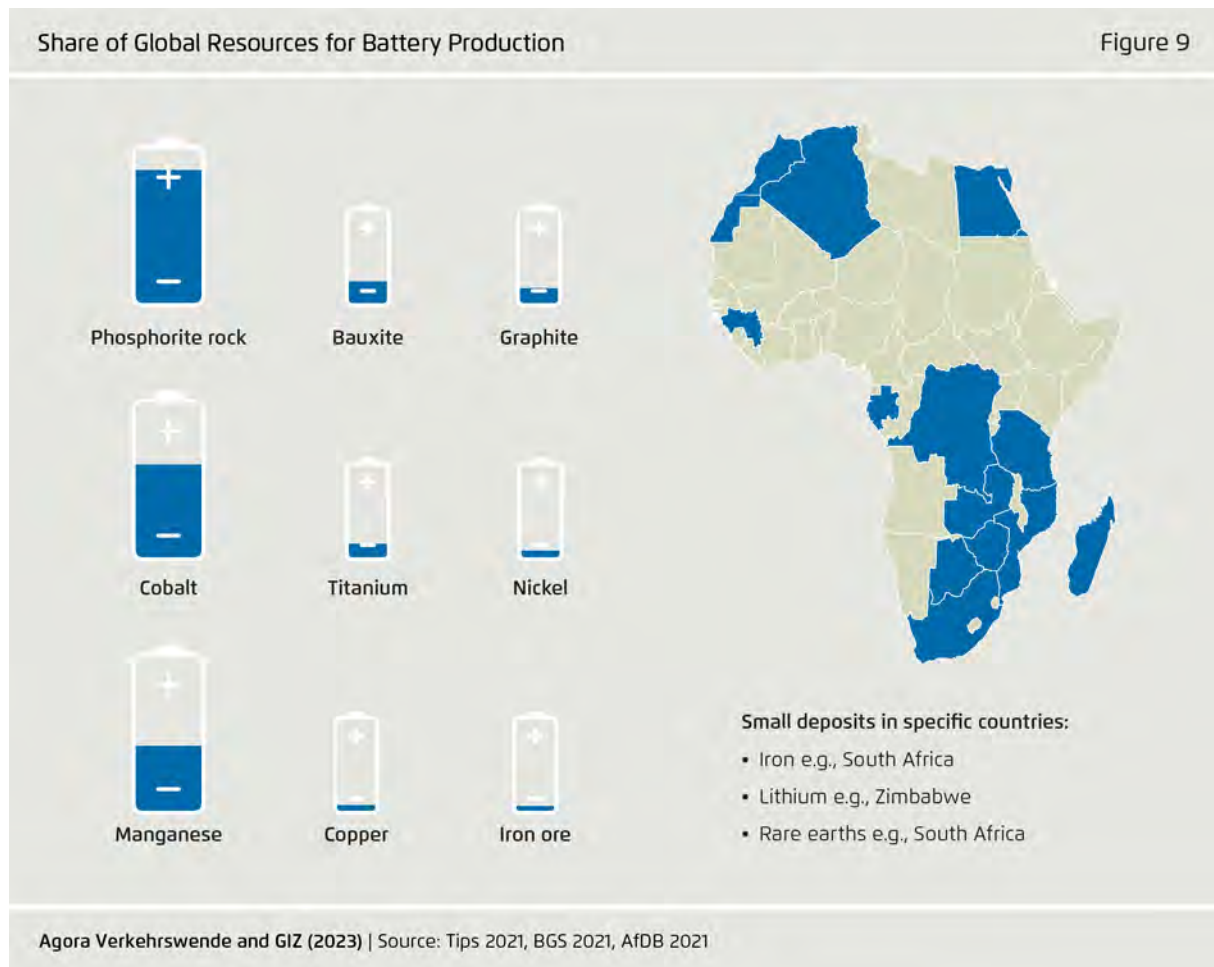
Another key role will be played by minibuses in the informal paratransit sector. Though they rack up many miles a year, their daily mileage can often be managed with a single battery charge. This makes their electrification attractive not only from an environmental point of view, but also in terms of economics, especially in times of historically high fuel prices. A team of companies and research institutions in South Africa has been investigating the feasibility of electric minibuses. Its field testing is scheduled to begin in early 2023<sup>29</sup>.

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29 CleanTechnica 2022

## The biofuel controversy

The production and use of biofuels is the subject of much controversy. Biofuels can be used in the short term to wean hard-to-electrify vehicles off petroleum and supply them with more environmentally friendly energy. Seven African countries already have biofuel blending programs, but they are not always implemented consistently and the land consumption is enormous. Particularly in countries with rainforests, there is a very high risk that the conversion of carbon sinks into plantations for the production of biofuels will increase rather than reduce emissions.



Finally, electrification has already begun in the large-bus sector. The first electric bus line opened in Cairo in 2019, and other electric buses are running in Cape Town and Addis Ababa. Some electric buses are even being manufactured in Africa. The Ugandan state-owned company Kiira Motors Corporation offers two variants, one of which (known as the Kayoola Solar Bus) has a battery and a solar roof fitted with solar panels. Sockets at every seat and a Wi-Fi network are also included. Basigo and Roam are now producing e-buses in Kenya.

And what about passenger cars? Morocco and Kenya have already taken initiatives to promote battery-electric vehicles. Some charging stations have been set up in Ghana and the government of the Cape Verde Islands wants to ensure that all government vehicles are electric by 2030. South Africa, too, has set ambitious electric car targets, and Egypt is waiving tariffs on the import of used

electric vehicles. In Africa, however, the electrification of cars and trucks is likely to follow the electrification of two-wheelers, three-wheelers, and buses. One reason why is that large numbers of used electric cars are not expected to enter the African market in the foreseeable future, though they will eventually.



Picture: Volkswagen South Africa

## Insight **08**

The motor-vehicle industry and African countries must work together to create added value in the domestic economy.

Africa is the largest used vehicle market on earth. From 2015 to 2020, its countries imported on average a total of 900,000 used passenger cars per year, mostly from the EU and Japan. This average is more than the 833,000 new passenger cars sold in Africa in 2021. The tightening of emissions regulations in the countries of the North has only increased the volume of used vehicles for export.

### Safety and emission standards for used vehicles are lacking

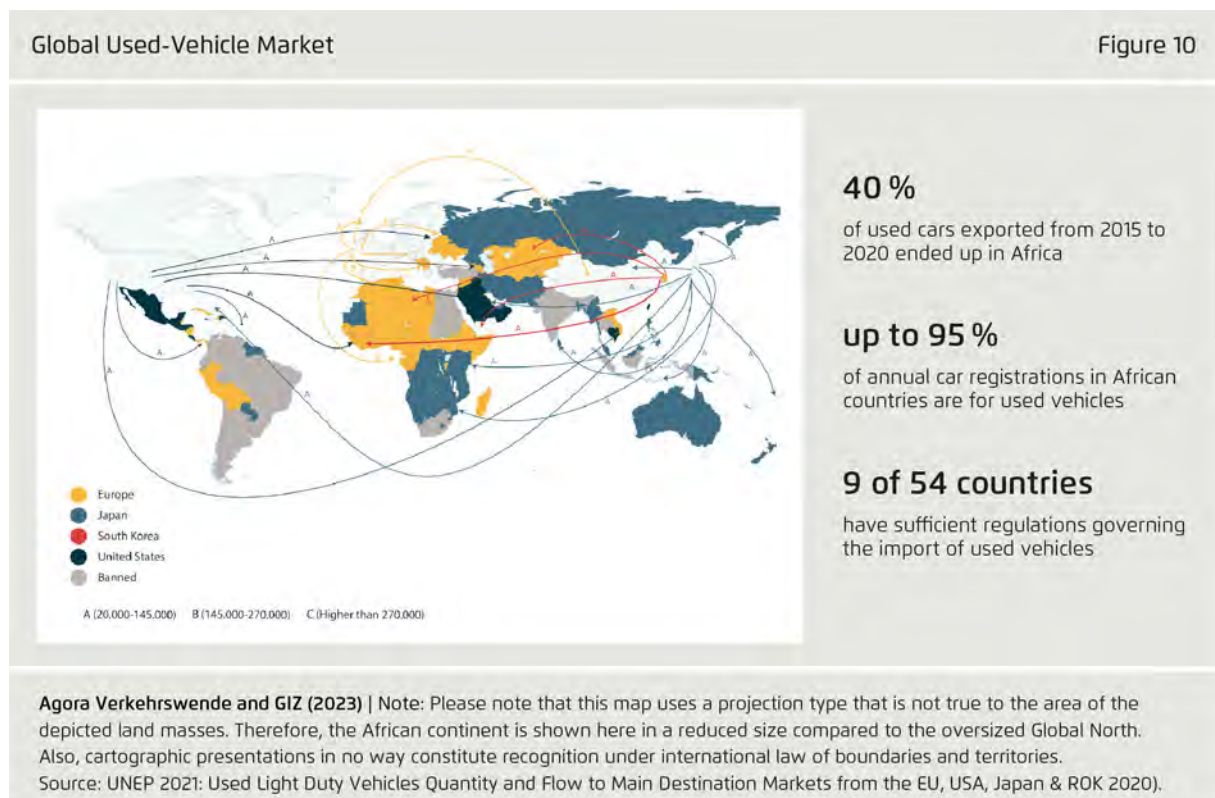
Often, imported used vehicles are old and do not meet the newest standards for safety and environmental protection. Nevertheless, the second-hand cars are relatively cheap, which presents a serious obstacle in developing Africa's own automotive industry. According to a study by the Dutch government, the average age of used vehicles exported from the Netherlands to some African countries is 17 to over 18 years, the same age that domestic vehicles are usually dismantled or scrapped.<sup>30</sup>

30 MIWM 2020

In most African countries, it is difficult to dispose vehicles properly due to the lack of infrastructure.

Besides being old and potentially unsafe, imported used vehicles contribute significantly to emissions. In the vast majority of African countries that import used vehicles, there are no standards on emissions or air pollution. And even vehicles equipped with emission control devices fare no better due to poor fuel quality. For example, recent findings show that the sulfur content in Nigeria's fuel is 204 times higher than is recommended for newer emission control systems.

Some countries have now started to set standards and regulate the used car market. East African Community (EAC) has a fuel standard with sulphur content in petrol and diesel set at 50 ppm. In Uganda, imported vehicles may be no older than nine years. Mauritius has banned the import of vehicles older than three years. And Egypt only allows the import of vehicles one year old or less, electric cars excepted. The 15 member countries of the Economic Commission of West African States (ECOWAS) have decided that imported cars must meet the EURO



4/IV standard and set 50 ppm as maximum allowable sulfur levels in imported fuelsto harmonize fuel specifications. All ECOWAS countries were now given 10 years to comply with the vehicle's directives. Other countries will follow. Guidelines from vehicle-exporting countries would also be helpful.

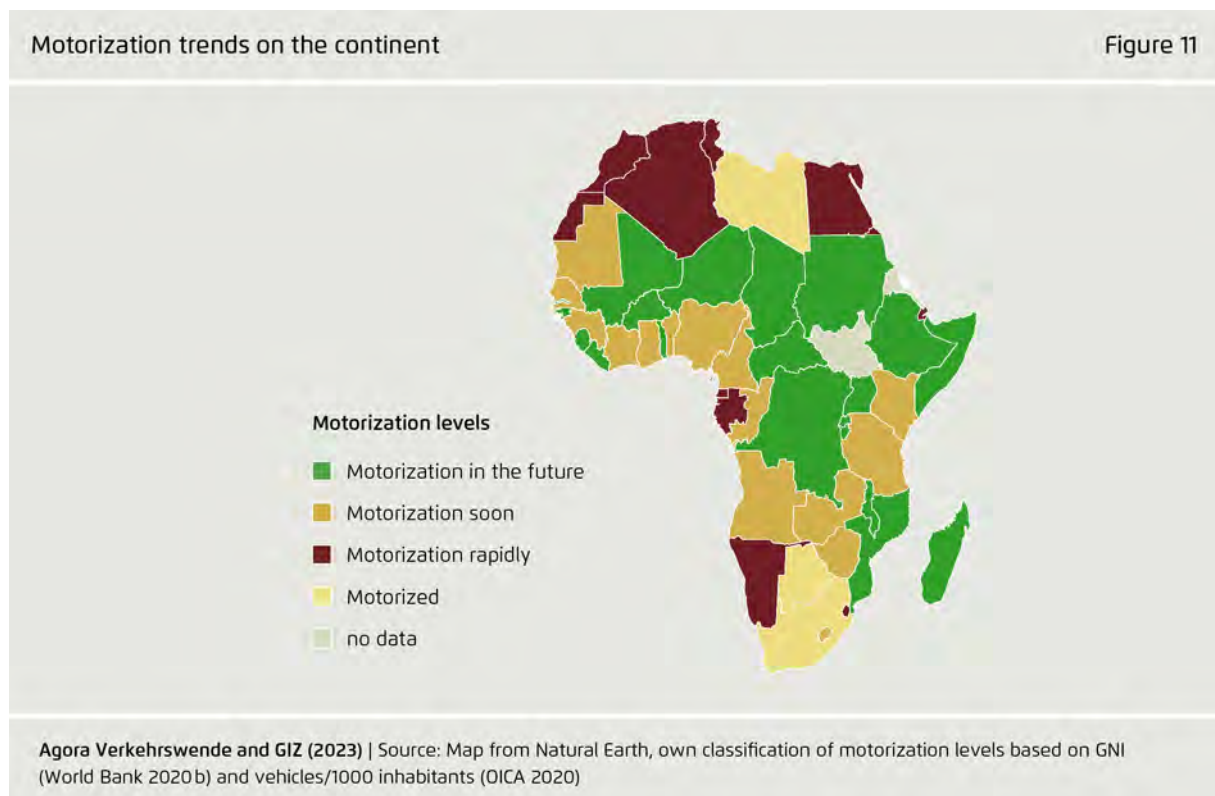
The to date inadequate standards for fuel, vehicles, and exhaust control have real consequences in Africa. Although the motorization rate per 1,000 inhabitants is lower than anywhere else, the concentration of respirable particulate matter with an aerodynamic diameter smaller than 2.5 micrometers (PM 2.5) is significantly higher than the global average. While the differences between African countries are large, vehicle emissions are significantly responsible for adverse health effects across the continent<sup>31</sup>.

Africa's motorization may be good for industrialized countries, but ultimately, it's a dead end. Awareness of the problem is gradually dawning in the EU. There, legis-

lators have decided to reform the End-of-Life Vehicles Directive to include a ban on the export of vehicles that do not comply with Euronorm 5.

Beyond the health and environmental problems of used vehicles is the issue of their availability: the supply could very well dry up in the not-too-distant future. The reason is that circular thinking is taking hold in the automotive industry. In 2020, the World Economic Form launched the Circular Car Initiative. Its goal is to decarbonize vehicles not only by electrifying the powertrain, but also by closing material cycles, i.e. by recycling vehicle parts whenever possible. Some manufacturers have estimated that the switch to a circular economy in the car industry will take 20 years. Achieving this goal will be more difficult if used cars continue to be exported to Africa.

31 Ayetor et al. 2021





## Ending the dependence on used vehicle imports through local vehicle production

Africa can avoid the serious problems of mass motorization that Europe and North America have experienced, even as its rate of motorization grows and increasing numbers of people use motorized transport. To do this, Africa must tackle a difficult challenge: ceasing its risky reliance on the import of end-of-life vehicles and developing value chains in its domestic industries.

Today, there is significant automobile production in only two African countries: Morocco and South Africa. Algeria and Egypt also have car-manufacturing capacity, but it is small by comparison. The main reasons for the industry's underdevelopment are competition from imported second-hand vehicles, the small size of national markets, and the lack of cooperation between African states. The establishment of the African Continental Free Trade Area (AfCFTA), founded in 2018, represents a crucial step for value creation in the African automotive industry.

European, Chinese, and Korean carmakers are already investing or planning to invest in Africa. What is spurring their turn to the African continent is not only the projected saturation of the markets in the Global North but also rising costs in China, which have raised the possibility of shifting production to the African continent. A number of African start-ups are also producing vehicles. These include Innoson Vehicle Manufacturing (Nigeria), Mobius Motors (Kenya), and the Moreza Auto Company (South Africa and Zimbabwe). Several pilot projects for electric vehicle production are also ongoing in Rwanda.

Manufacturing on the African continent may create value but it will not ensure zero carbon transport as long as most vehicles continue to come with combustion engines. According to a recent assessment by the International Council on Clean Transportation (ICCT), electric cars have only a negligible market share in Africa.

The manufacture of electric vehicles in Africa will generate more advantages if it also includes domestic battery production. The market for batteries in Africa stands to be enormous: from outfitting new electric vehicles to retrofitting its immense fleet of motorized two-wheelers

and minibuses. And this does not include additional sales from exports.

## Battery production holds great potential for domestic value creation

Fortunately, the conditions for producing batteries in Africa are propitious. The continent contains rich deposits of the minerals needed for battery and hydrogen technologies. Africa has more than 40% of the world's reserves of cobalt, manganese, and platinum, and some countries, including Zimbabwe, Namibia, Ghana, Mali, and the Democratic Republic of Congo, have abundant supplies of lithium, another crucial raw material for battery production. Africa's deposits of rare earth metals, especially in its southern and eastern regions, are significantly smaller than those of China, but they are still quite significant compared with other regions of the world.

The benefits of domestic battery production will obtain only if companies take into account environmental and social concerns when extracting raw materials. The mining sector is notorious for its poor performance on both scores. International companies and national African governments must work together to create value for all of society by ensuring that raw materials for electric vehicles are mined and processed in a manner that is fair and sustainable. The environmental benefits of driving electric vehicles will matter little if mining and battery production ignore the environment.

A momentous development in the creation of an African industry for vehicle batteries is the cooperation agreement signed in May 2022 by Zambia and the Democratic Republic of Congo (DRC/Zambia Battery Council). Providing a framework for building the supply chain and battery production facilities, the agreement provides important impetus for economic development and represents a step towards a net-zero future.



Picture: DisobeyArt/Stock

## Insight 09

Africa possesses enough renewable energy to power the global transition to sustainable transport.

Africa's potential for the generation of renewable energy is enormous – as high as 2.4 million terawatt hours (TWh) annually, according to experts. By way of comparison, Africa's electricity generation in 2020 amounted to 827 TWh, and the International Energy Agency (IEA), in its Sustainable Development Scenario, projects generation to reach 1400 TWh by 2030 and 3488 TWh by 2050. This means that the potential for renewables is more than one thousand times greater than Africa's expected power demand in 2030. Furthermore, this potential is more than sufficient to electrify Africa's entire transport sector and to decarbonize Africa's energy production (coal, petroleum, and natural gas). In theory, it is even enough to meet the rapidly growing global demand for green hydrogen and e-fuels.

## Renewable potential has so far remained largely untapped

Africa's immense solar energy potential is fairly evenly distributed; on average, the continent receives some 2100 kilowatt hours of solar radiation per square meter. Its development potential for wind power is also large, particularly in the coastal regions of North Africa, East Africa, and southern Africa. For hydropower and biomass, the best locations are in Central Africa. Finally, geothermal energy can be harnessed in the East African Rift Valley, which stretches from Mozambique to Djibouti.

As nearly limitless as Africa's potential is, it has so far remained largely untapped. There are enormous differences between African countries: in some (Benin), no more than one percent of electricity is generated from renewable energy sources, while elsewhere (Ethiopia) almost all electricity is renewable. Across the continent, at least one-fifth of electricity was "green" in 2020, but apart from the hydropower generated by large dams, modern renewables are barely used. Wind energy accounted for only 17 terawatt hours (2%) of Africa's electricity mix, while photovoltaics accounted for just 10 TWh<sup>32</sup>. On top of that, more than three-quarters of installed solar capacity is located in just two countries: South Africa and Egypt.

Most of Africa's electricity is generated from fossil fuels, which not only is harmful to the environment and climate but also makes little economic sense. The levelized cost of electricity from renewable energy is usually lower than that of electricity generated by coal- or gas-fired power plants. Moreover, the cost of battery storage has also fallen, although the downward trend has recently slowed due to rising commodity prices.

Studies by the International Renewable Energy Agency (IRENA) have found a steep upward investment trend: from 2000 to 2009, less than 5 billion dollars were invested in renewable energy in Africa; between 2010 and 2020, the figure rose to 55 billion dollars. Africa's average annual growth rate was significantly higher than the growth rate in other regions of the Global South and even greater than the global average. Nevertheless, only a good two percent of global investments in renewables between 2010 and 2020 took place in Africa. The limited uptake of renewable energy on the continent – despite its vast potential – is most likely attributable to the high initial investment costs required to build up necessary infrastructure. This highlights the need to attract and support international investment into the continent.

Transforming the energy system and unlocking potential for the low-cost generation of climate-friendly electricity as well as renewable energy carriers such as hydrogen and its derivatives will make it possible to meet the growing demand for energy. It will enable African countries not only to improve and decarbonize their own energy supply and parts of the transport sector, but also to support other regions of the world in their decarbonization efforts. If solar modules and batteries can be produced in Africa, many new jobs are likely to result. Indeed, the IEA estimates that for every gigawatt of additional capacity as many as 1,300 jobs could be created.

In the transport sector, the direct use of renewable electricity is the most efficient option for powering drivetrains. However, some forms of transport (in particular aviation and shipping) will require renewable synthetic fuels, or e-fuels. These can be produced using power-to-x (PtX) fuel synthesis, in which hydrogen is separated from water using renewable electricity and then combined with carbon dioxide to produce methanol, or alternatively with nitrogen to produce ammonia. Provided the carbon dioxide used to produce the fuel is

32 IEA 2021b

captured directly from the air or obtained from biogenic sources, and assuming the electricity is generated from renewables, the vehicles running on synthetic fuel are net zero. Given the difficulty of electrifying aircraft and ships, such fuels are probably the only option for reducing fossil-based emissions to zero.

## Africa can play an important role in the global market for green hydrogen

The production of green hydrogen offers considerable opportunities for many African countries, as green hydrogen will play a major role in the global transition to clean energy. In a decarbonized world, large quantities of hydrogen will be needed for chemical processes, for iron and steel production, and for electricity generation (to back up fluctuating renewables). The IEA estimates that by 2050 hydrogen will meet about 10% of the world's final energy demand. South Africa already has many years of experience in producing synthetic fuels from coal. It could leverage that experience to produce electric fuels from green hydrogen on a large scale.

However, hydrogen is climate-friendly only if it is produced with renewable electricity. Due to its enormous potential to generate large amounts of renewable electricity at low cost, Africa has a locational advantage in this respect. Many African countries would be able to produce hydrogen for less than two dollars per kilo of H<sub>2</sub>. Europe and large parts of North America would not be able to compete with these prices, creating large export markets for African producers. The EU has already clearly expressed its interest in hydrogen from Africa. However, there is also a recognition that the production of hydrogen should not divert electricity from areas where it is needed more, and that sustainability criteria should be adopted in the regulation of exports (e.g. related to poverty alleviation, the safeguarding of water resources, and prevention of land grabbing).

In their efforts to decarbonize, airlines in the Global North are counting on the future availability of cheap e-fuels – including hydrogen – produced in and exported by Africa. Yet instead of transporting hydrogen over long distances, hydrogen-producing countries could instead combine it with CO<sub>2</sub> to produce synthetic aviation fuels for domestic consumption and export. In such cases,

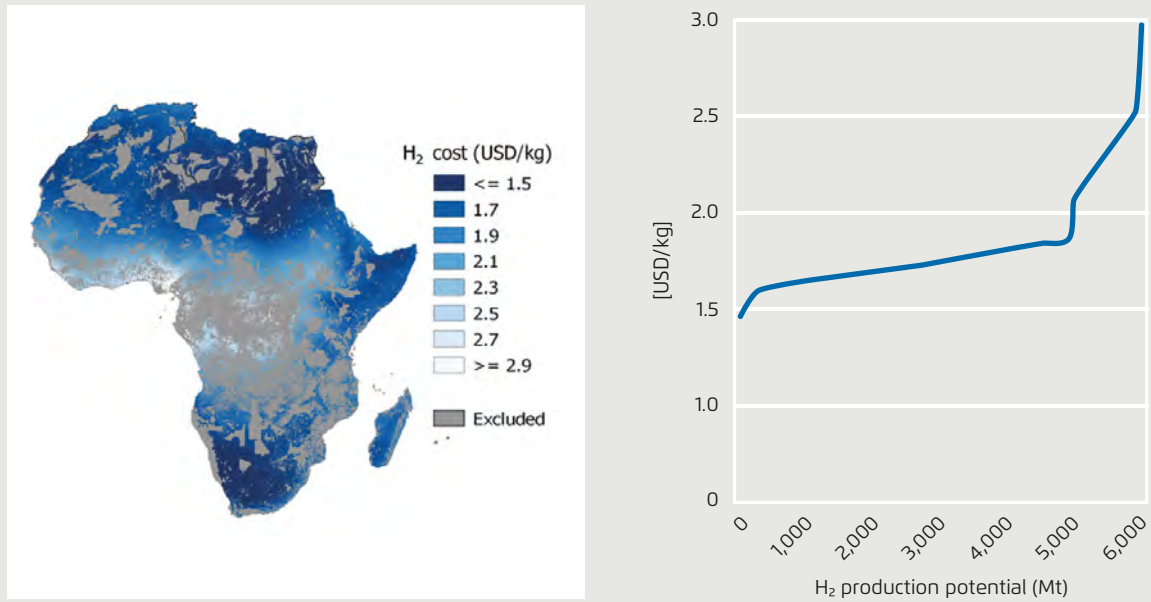
“book-and-claim” systems could be used to decouple net-zero products from the physical location of the consumer. For example, imagine an airline operating in Germany wishes to use sustainable synthetic aviation fuel, but no such fuel is available domestically. Using a book-and-claim system, the airline could pay for the use of such e-fuels elsewhere – that is, where there is a plentiful domestic supply of hydrogen for e-fuel production, such as in Africa – and thus claim a reduction in the company's carbon footprint.

According to a review published by the International Energy Agency, there are currently 17 projects in Africa for the production of low-carbon hydrogen. To name just a few: Morocco has initiated the Green Hydrogen Cluster to support the creation of a hydrogen sector; Egypt has included green hydrogen in its National Energy Strategy 2035; and Namibia's Southern Corridor Development Initiative launched Hyphen, an effort to create gigawatt-scale capacity for the production of green hydrogen. The last initiative is particularly immense. At an estimated cost of \$9.4 billion, it is almost as large as Namibia's \$11 billion GDP.

In this way, sustainable hydrogen and e-fuel production offers Africa new opportunities not only for economic development, but also to play an important role in the broader global transition to sustainability, particularly in aviation and maritime transport. However, for this to occur, continued efforts to attract international investment and foster sustainable development are required.

Hydrogen production costs and potential supply in 2030

Figure 12



Agora Verkehrswende and GIZ (2023) | Source: IEA (2022 a): African Energy Outlook 2022: p. 154



Picture: Geoff Sperring/shutterstock

Insight  
**10**

The electrification of rail and road makes it possible to decouple the volume of trade from the level of freight transport emissions.

Today, much of Africa remains excluded from global trade. As recently as 2016, Africa's share of global trade was less than 3%. Only 4.4% of this was attributable to intra-African trade<sup>33</sup>. For African countries, this has put out of reach enormous potential for job-market expansion, value creation, and income generation.

## New trade corridors and the African Free Trade Area will increase freight traffic and require sustainable transport solutions

The establishment of the African Continental Free Trade Area in 2019 accelerated intra-African trade, expanding the integration of the continent and helping develop the manufacturing sector. According to estimates by the UN Economic Commission for Africa, freight transport volume will double by 2030 relative to 2019 levels, and growth will be around 28% higher once a single continental market is created<sup>34</sup>. The African Union's Programme for Infrastructure Development in Africa (PIDA) is designed to address the challenge of creating the necessary infrastructure. One difficulty is ensuring that the increased transport volumes accompanying the expansion of intra-African trade do not lead to setbacks in environmental protection and climate change mitigation.

In principle, there are two ways to take the necessary precautions: one is to use transport modes whose current level of technology is friendly for the environment and the climate (such as electrified rail); the other is to advance current modes of transport (such as truck transport) so that their use has little or no impact on the environment or the climate. Efficiency improvements in logistics can also reduce climate impacts by, say, using digital technology to increase capacity utilization and avoid empty runs. This not only pays off for the environment and climate; it also reduces the up to 60% increase in transport costs currently caused by inefficiency in logistics.

33 UNCTAD 2021

34 UNECA 2022 a

## Roads are the main vector of intra-African freight transport

Today, more than three-quarters of African freight across borders is transported by road and just under a quarter by water. The relatively high proportion of maritime transport is due to inadequate transport networks on land: it is easier and cheaper to transport goods from Lagos (Nigeria) to Mombasa (Kenya) by ship than by any other means. However, ships only reach coastal areas, not regions further inland. Railways could help, but though the one form of transport that is easiest to make compatible with environment and climate goals, they barely rank in the continent's transport landscape, accounting for only 0.3% of the modal split.

## Current rail infrastructure faces various challenges

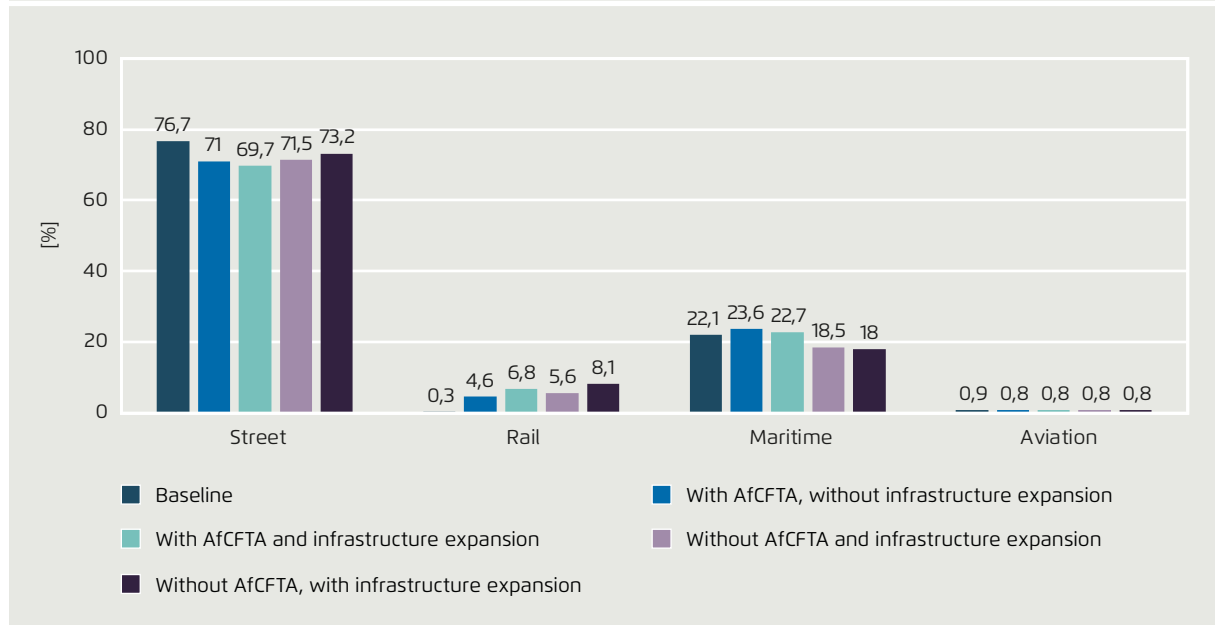
The fact that rail plays virtually no role is mainly due to inadequate rail infrastructure. In fact, much of Africa's rail network originated during colonial times. Back then, railway lines were mainly used to transport raw materials from the interior of the continent to the coastal ports; they were not built to connect the regions of inland Africa, which in some instances were occupied by competing colonial powers. Another problem is that railways in Africa have five different gauges, which is also a legacy of the colonial era. The International Union of Railways has identified a number of other factors that inhibit rail transport in Africa, including inadequate maintenance of track and signaling, lack of rolling stock, and shortcomings in management.

Another problem is that many routes are still serviced by diesel locomotives, which limits the reduction of emissions in rail transport. African governments do not want this to remain the case, however. One of the lighthouse projects of the African Union's Agenda 2063 is the African Integrated High-Speed Railway Network (AIHSRN) with the long-term vision of building an extensive rail network across Africa, linking cities and regions and eventually becoming fully electrified. It is not only freight transport that will benefit; passenger routes are currently being established in many places on the continent<sup>35</sup>.

35 RailwayGazette 2022 & UIC Africa

Various Scenarios for Freight Transport Demand (% for each mode of transport)

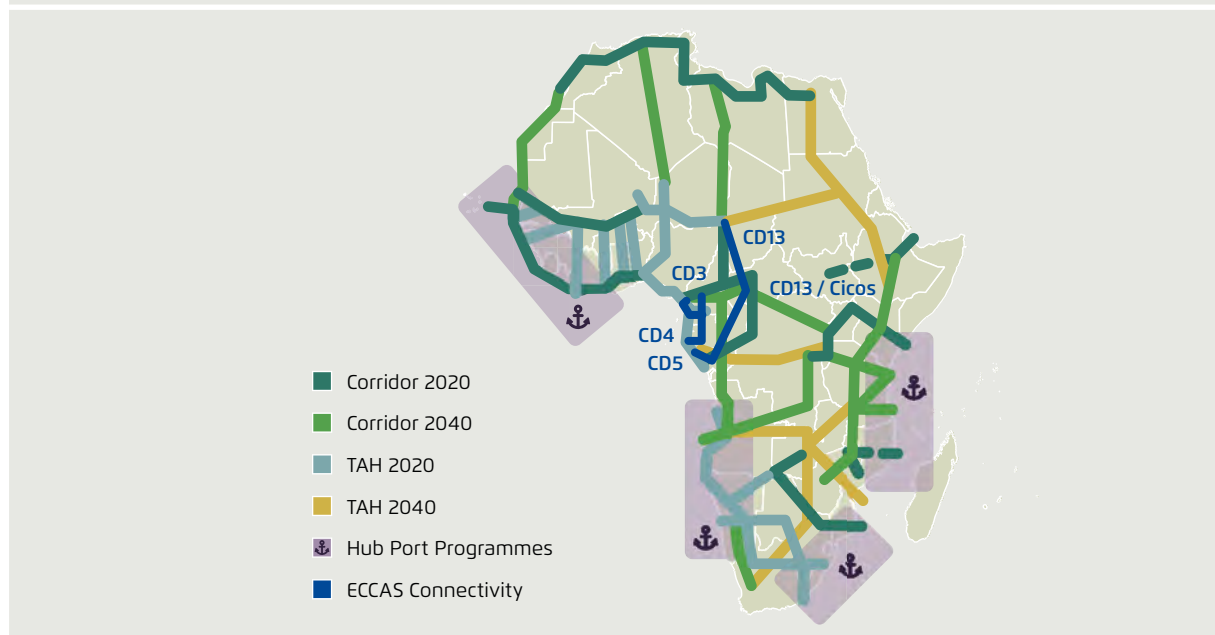
Figure 13



Agora Verkehrswende and GIZ (2023) | Source: UNECA 2022 b

Planned Expansion of Transport Infrastructure

Figure 14



Agora Verkehrswende and GIZ (2023) | Source: PIDA 2012



## Achieving a significant share of future freight volumes for rail will require a massive expansion of the electrified rail network

According to the UN Economic Commission for Africa, some 9,000 kilometers will have to be built in order to fill existing gaps in the system. An expanded rail network could transport more than 50 times as much as today and increase its share of intra-African freight transport to almost seven percent. According to estimates by the African Development Bank, more than \$100 billion will be needed for rail infrastructure expansion<sup>36</sup>. Investment in new railway vehicles would amount to an additional \$36 billion<sup>37</sup>. Today, Africa's largest external investor is China. Its Belt and Road Initiative will invest \$13.8 billion in the East African Rail Master Plan alone.

The expansion of the rail network carries risks and opportunities. When it comes to the former, careful planning and implementation can limit negative impacts on the environment and pre-empt social conflict (such as the loss of income opportunities along truck routes). But the rail initiative is also a chance to modernize the entire rail infrastructure and gradually replace diesel traction with electric traction in the form of overhead lines, batteries or fuel cells, eliminating local emissions. If the traction current is generated from renewables that are abundantly available in Africa, trains will become not only efficient but also net-zero.

## Electrifying freight transport on the roads will be crucial for net-zero transport

Nevertheless, even under the most optimistic assumptions, the bulk of Africa's growing freight volume (both nationally and across borders) in the future will still be transported by road – 70% versus 90% today. Accordingly, the expansion of road infrastructure is one of the concerns of Agenda 2063, which identifies nine routes in the Trans-African Highway Network for freight transport. Between 2004 and 2018, the African Development Bank co-financed the construction of 12,700 kilometers of road; in order to achieve the objectives of Agenda 2063, 57,000 km still need to be added<sup>38</sup>.

More roads with more trucks, however, means that CO<sub>2</sub> emissions from road freight transport will increase significantly. Trucks can be decarbonized but doing so will be a challenge not only for African countries, but also for those in the Global North.

Trucks that rely on heavy diesel engines are particularly difficult to decarbonize. As with trains, electrification is the silver bullet, but the technology and the time horizon are still unknown. The options under discussion include electric batteries, overhead lines, hydrogen fuel cells, and green synthetic fuels. Which of these technologies is superior and feasible depends on many factors, and it may be that one technology is better for short-haul trucks and another for those with ranges of 800 kilometers or more. In a recent study, the ITF<sup>39</sup> concluded that in Europe battery electric trucks and electric road systems (overhead catenary wires) are more cost effective than hydrogen even in the longer-term.

Decoupling trade growth from emissions growth is a challenge, but it is one that can be overcome. The possible options are clear. Identifying and financing the right ones for Africa is what matters now.

36 AfDB 2015

37 UNECA 2022

38 UNECA 2022

39 ITF 2022



Picture: Emmanuel Kwizera/shutterstock

## Insight **11**

Climate protection and resilience are the foundations for the development of Africa's transport infrastructure.

Many roads, bridges, railway lines, and power grids on the African continent are in poor condition. This is particularly true for rural areas. And the infrastructure in many places is not equipped to handle the growing population. This affects the daily lives of millions of people and jeopardizes economic development. For example, power outages or interrupted transport routes drive up the costs of production and distribution. What is more, the fragile infrastructure is not made to withstand the stress of storms, floods, landslides, heat waves, which are becoming more intense as a result of climate change. Extreme events that were rare in the past will become more frequent in the future.

The Programme for Infrastructure Development in Africa (PIDA) estimates that repairing weather-related damage to roads and bridges will cost around \$20 billion between 2015 and 2025 without factoring in man-made global warming. The impact of climate change increases the cost to \$74 billion. The \$54 billion difference represents an opportunity cost. But coming up with the money will be a tall order. Many African countries already lack the funds to build railways, roads, and bridges that are urgently needed today.

## The high investment needs for infrastructure development face limited funds from national governments and international donors

If current trends continue, there will be a gap between what needs to be invested in infrastructure and what can be financed. The Global Infrastructure Hub estimates that the investment gap across all infrastructure sectors (energy, telecommunications, water, and transport) will total \$1.7 trillion by 2040, or nearly 40% of the required investment. Nowhere is the gap as large as in the transport sector, which accounts for only 27% of all infrastructure investment, while the global average totals 45%. This gap is particularly evident for rail, which accounts for only 3% of infrastructure investment versus 12% globally<sup>40</sup>.

The effects of climate change will also place greater demands on infrastructure in the future than has been

the case to date. To ensure that maintenance, repair, and reconstruction do not tie up an unnecessarily large amount of resources, it makes economic sense to use the resilience of planned infrastructure as a criterion for investment. The additional costs of resiliency do not yet figure in the existing investment gap, which already totals \$1.7 trillion.

This challenge is particularly evident in a Ghanaian study investigating the vulnerability of transport infrastructure to flooding. Researchers found that around 27% of railways and 20–27% of roads in Ghana could face regular flooding by 2050. The study also looked at what the consequences would be if transportation routes were disrupted. Its authors projected that unpassable roads could prevent 13 million people from reaching the nearest health clinic, while train cancellations could affect nearly 45,000 rail customers on a daily basis. Accra's supply of goods from suburban and rural areas would also be at risk. By 2030, the cost of repairing road damage from flooding could be as high as \$130 million in Accra alone, and reach \$3.9 billion for the country as a whole – three times Ghana's investment in the transport sector in 2019. This is one reason why the country has developed a Roadmap for Resilient Infrastructure in a Changing Climate<sup>41</sup>.

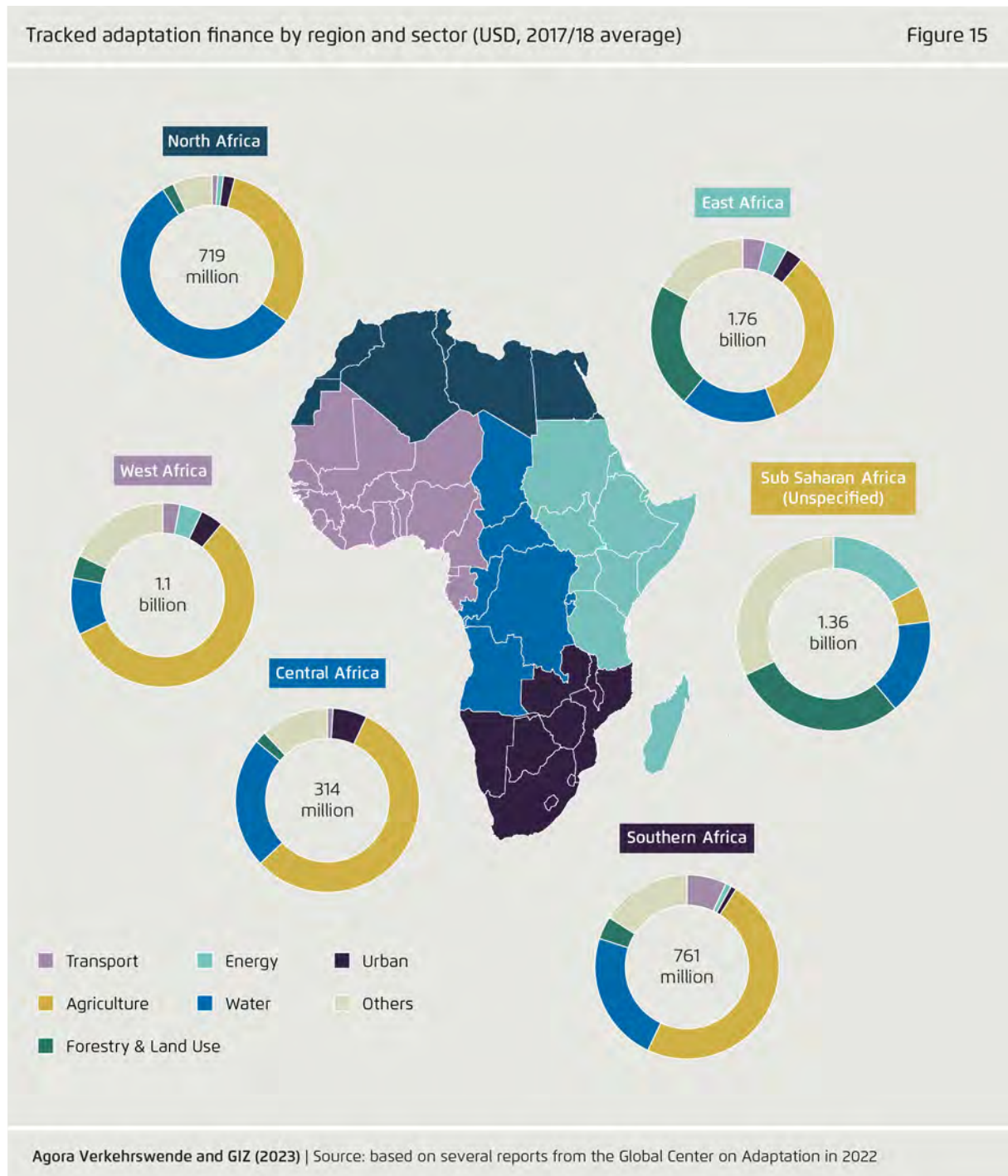
## Climate resilience, traffic safety, and environmental protection will be guiding principles for infrastructure projects

The combination of vulnerable infrastructure and increasing weather extremes has set a pernicious infrastructure trap: If African governments invest their limited resources in restoring old infrastructure, they end up with little to invest in new infrastructure. According to the World Bank, it costs one to two percent more to build climate-smart infrastructure projects<sup>42</sup>. But even though climate-smart infrastructure is a no-regret option that pays off in the long run, planning proactively and raising the higher investment costs can often pose a major challenge.

40 Global Infrastructure Hub 2017

41 Adshead et. al 2022

42 WorldBank 2010



The African continent is particularly affected by the consequences of climate change. Accordingly, the construction of resilient roads, railways, and power grids is absolutely necessary for Africa's future. At the same

time, the need to prepare for the effects of climate change is also an opportunity to build infrastructures that help mitigate climate change in the medium to long term.

## Climate change impacts could counter economic growth – investments must consider resiliency

Due to the dramatic increase in the concentration of greenhouse gases in the earth's atmosphere, climate change is already a tangible reality in Africa today. It is important that governments avoid "either/or" thinking. They must build resilient infrastructure while reducing emissions; they must make sure that railway lines are electrified but also safe from flooding.

But climate smart investment is easier said than done. The planning of infrastructure projects will have to follow entirely new rules. Climate adaptation strategies like the one in Ghana prioritize climate risks in infrastructure planning. They can serve as a model for other African governments looking for solutions to address the impact of climate change.

International cooperation has long neglected measures for climate change adaptation. According to calculations by the Global Center on Adaptation, only 2.3% of public development cooperation (ODA) funds from 2010 to 2019 were dedicated to climate change adaptation, and only 6.3% went to the transport sector. UNCTAD's latest World Investment Report 2022 shows that between 2011 and 2021, the only project in the Global South to attract foreign funding for the adaptation of non-water-related infrastructure was based in the Marshall Islands<sup>43</sup>. On the African continent, a large part of the adaptation costs is still covered by local governments, although it is clear that, in view of Africa's relatively low levels of past emissions, they bear little responsibility for the damage.

## Availability of funds and trained planners will determine the speed of sustainable infrastructure expansion

The task today is to translate abstract commitments into concrete action. But the design, construction, and management of infrastructure projects also requires that priority be placed on the education of planners. For it is in their minds that change begins.

The planners of tomorrow must understand that future infrastructure will face more unpredictable and extreme events than in the past. It is also important that they systematize and evaluate data on the local impacts of climate change. Although much data already is available, governments have yet to take full advantage of it in their planning.

The knock-on effects of investments, or the failure to make them, must also be taken into account. Public expenditures on infrastructure – paving roads, say – may appear uneconomical at first glance because the costs are not offset by lower maintenance. But once governments consider the effects of not investing – such as disruptions to freight transport – the economic calculation may look different. National governments should base their own investment decisions on such considerations and set appropriate framework conditions for foreign investment.

Finally, it is crucial that more funds be mobilized to reduce the gap between current investment levels and what Africa needs. The countries of the Global North bear a particular responsibility here, because it is their past emissions that are chiefly at fault for the effects of climate change today.

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43 UNCTAD 2022



Insight  
**12**

It is the joint responsibility of national governments and international investors to coordinate financing decisions.

The countries of Africa must not repeat the development of the Global North, which has brought unimagined disaster to the planet. Rather, it is of great importance and benefit for them to pursue different paths, leapfrogging fossil technologies. At the same time, many places in Africa lack access to electricity and to clean water, to roads, and to railways. The quality of African infrastructure is the lowest of any region in the world. These are not auspicious conditions for spearheading progress.

According to the African Economic Outlook 2019, Africa would need to invest between 130 and 170 billion dollars in infrastructure annually<sup>44</sup>, while other, more recent publications have put the figure as high as 240 billion dollars<sup>45</sup>. In 2019, African invested only 100 billion dollars a year; around one-third went to the transport sector. Although this amount is 24% higher than in 2017, the COVID pandemic has likely wiped out much of the previous increase<sup>46</sup>.

In 2018, China was by far the largest single investor in Africa's infrastructure. As part of its geopolitical development strategy, the Belt and Road Initiative, China contributed around a quarter of Africa's infrastructure investment, of which \$6.6 billion went to transport infrastructure. Together, African governments invested \$37.5 billion, just over half of which was for transport infrastructure<sup>47</sup>.

## International investment falls short of Africa's needs

These numbers are considerable, but if Africa is to develop its transport sector and meet its Sustainable Development Goals (SDGs) without accelerating global warming, the current budget is far from sufficient. The list of possible measures and investments is enormous. It ranges from the expansion of road and rail networks to the rapid ramp-up of renewable electricity generation and transmission. Africa also has a chance to design its cities to provide climate-friendly transport for rapidly growing populations and to cater for urban development

which enables, not hinders mobility. If pedestrians are to continue to forgo motorized transport, then clean and safe footpaths and cycle paths with lighting and drainage are needed. And of course the growing rural population has an equal right to mobility that can hardly be met without sufficient financial means.

All of this adds up to a financial challenge that goes far beyond a "business as usual" approach, especially since training and innovation are not even included in the ICA's estimates. But innovation will be necessary to meet the enormous challenges – not only in Africa, but also around the world. The continent's young population offers a wellspring of potential, yet investments are needed if Africa is to unlock it.

## The overriding question: How to raise the needed capital?

Good governance is a word that comes up frequently in this context. Combating corruption, tax evasion, and tax avoidance more vigorously is one way for African governments to mobilize much more capital. Illicit financial flows, which the Sustainable Development Goals is meant to fight (Indicator 16.4.1), deprive public coffers of tax and custom revenues. According to UNCTAD, capital flight in Africa totals 88.6 billion dollars per year, around half of which is due to trade misinvoicing alone. However, tax evasion is far from being exclusively an African problem. According to a study by the University of London, tax evasion costs the EU more than €800 billion a year<sup>48</sup>. Eliminating this evil is obviously more difficult than speaking its name.

The capital market would be another way for African governments to raise money for infrastructure financing. However, many African countries struggle with poor creditworthiness. Many countries in the Global South have had to devote a large and growing share of their government revenues to servicing their debt, even as highly indebted industrialized countries have received low interest rates in recent years. Whether private rating agencies have played a sinister role in this outcome is unclear; the African Union has in any case repeatedly criticized their ratings as unjustified, and they have a

44 AfDB 2019

45 Global Infrastructure Hub 2021

46 ICA 2019

47 AfDB 2019 a

48 Murphy 2019

point. Twenty-eight of the 29 African countries in the Sovereign Ratings List have ratings that advise against investment. Now the African Union itself is in the process of creating its own ratings agency. UNCTAD, too, has already advocated for the creation of a publicly controlled ratings agency.

Finally, the private sector could also contribute more to infrastructure development in Africa. From the perspective of private investors, however, only investment outlays that can be recouped through user fees (on ports, airports, toll bridges, and roads, etc.) or those that can be covered by local or national governments in the form of public-private partnerships are attractive. As a result, only two percent of private infrastructure investment in Africa went to transport in 2018<sup>49</sup>.

Up to now, money from private sources has gone almost exclusively into the information and communications infrastructure (ICT) and into the energy sector. But the development of the energy sector also requires significantly more capital than has recently been made available by the private sector. In 2018, China invested three times as much as private entities did in the energy sector, which is crucial for transport sector improvements.

However, various studies suggest that significantly more private capital could be mobilized for Africa's infrastructure development. Some have spoken of Africa's "infrastructure paradox"<sup>50</sup>: the immense gap between the willingness of international investors to invest and their actual investments. Regulatory risks and lengthy approval procedures are two of the main causes, but there is also a lack of economic incentives, especially when it comes to the needs of low-income population groups.

A more reliable political environment, better project management, and more intensive cooperation with multilateral financial institutions may indeed solve the investment paradox in the transport sector. But even they do, it is likely to take many years. However, when it comes to fighting climate change, time is of the essence.

## Coordination of major investors under African institutions has benefits for climate protection and sustainable development

New partnerships will therefore have to be forged. As far as sustainable infrastructure for growing transport volumes is concerned, the countries of the Global North will need to dig deeper into their pockets. This may also involve recalibrating the relationship between projects and budget support in favor of the latter. "Policy-based lending," for example, makes it possible to link funding to sector reforms and the introduction of responsible policies. At the same time, African countries will need sufficient numbers of well-trained and well-compensated public administrators if they are to tackle the challenges that lie ahead. Hence, it is important that Africa's development partners help finance a training offensive for the continent's future planners.

International climate financing might be a good framework for funding transport-sector development in African countries, which in turn could stimulate more private-sector investment. Such funding would help ensure that Africa's transport sector does its part for the climate while providing an opportunity for the countries of the Global North to fulfill its obligations to the Global South. It is also important to bear in mind that investments can be put to particularly good use when coordinated between multiple investors. The responsibility for coordinating infrastructure investment across different sources and geopolitical interests and for prioritizing them in accordance with the goals of sustainable development must lie first and foremost with the African governments and the African Union. But such a centering of African institutions will require efforts to further strengthen them.

Intensifying geopolitical competition, growing tensions between global actors, and painful losses in real income as a result of rising energy prices, even in wealthy parts of the world, do not make these challenges any easier. Nevertheless, we must do everything in our power to meet them. In the end, no one will be able to escape the consequences of climate change. For nothing less than humanity's future is at stake.

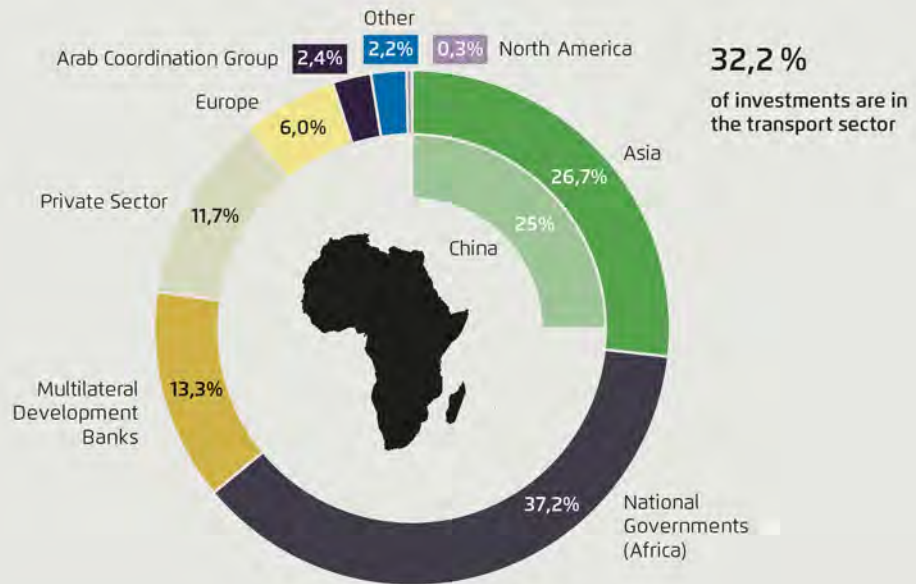
49 ICA 2019

50 McKinsey 2020



Investments in Infrastructure

Figure 16



Agora Verkehrswende and GIZ (2023) | Source: ICA 2018, Global Infrastructure Outlook



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Agora Verkehrswende is a Berlin-based think tank that seeks to promote climate-friendly mobility. Non-partisan and non-profit, it works together with key stakeholders in the fields of politics, business, academia and civil society to decarbonise the transport system. To this end, the think-tank team develops evidence-based policy strategies and recommendations.

The Advancing Transport Climate Strategies (TraCS), funded by the German Federal Ministry for Economic Affairs and Climate Action's International Climate Initiative supports developing countries in assessing transport GHG emissions, in analysing emission reduction potentials and in optimising the sector's contribution to the mitigation target in countries' NDC.

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**Deutsche Gesellschaft für Internationale  
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Dag-Hammarskjöld-Weg 1-5 | 65760 Eschborn | Germany

P: +49 (0)61 96 79-0

F: +49 (0)61 96 79-11 15

info@giz.de

www.giz.de



**Agora Verkehrswende**

Anna-Louisa-Karsch-Str. 2 | 10178 Berlin | Germany

P +49 (0)30 700 14 35-000

F +49 (0)30 700 14 35-129

www.agora-verkehrswende.de

info@agora-verkehrswende.de

