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City clusters, connectivity and economic integration in Africa

This chapter analyses the implications of the emergence of city clusters across Africa. It provides a new methodology to identify clusters of cities and shows that Africa has a large and growing number of such clusters. Subsequently, the chapter outlines the economic potential that clusters offer and discusses the main obstacles to closer economic integration that cities within clusters face. It highlights the need for better infrastructure and provides new metrics of the African road network. Applying a gravity model of trade, the chapter shows that even small border costs can lead to major reductions in trade flows between cross-border cities.


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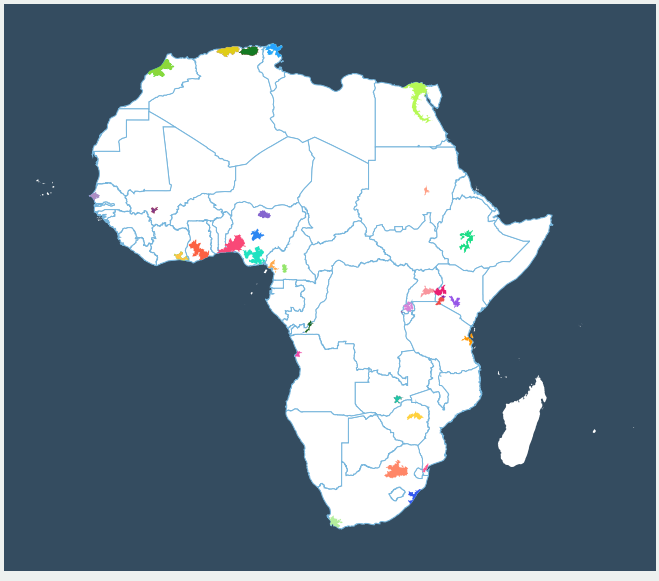
In Brief

City clusters as opportunities for economic development

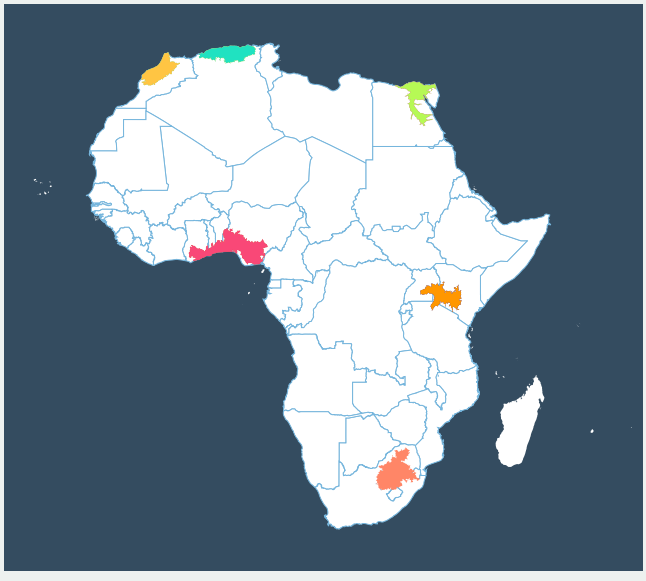
- Africa's rapid urbanisation process is changing the urban geography of the continent. Cities are emerging rapidly and small cities are turning into major urban centres. Since 1990, the number of cities in Africa has more than doubled, from 3 300 to 7 700. This has led to the development of clusters of cities, with cities located in close proximity to each other.
- City clusters provide a new opportunity for economic development in Africa. Many of the world's most successful cities are located in clusters of cities, because the clusters provide an economic ecosystem of customers, suppliers, investors and innovators that is much larger than that of any individual city. This particularly benefits intermediary cities that do not have the economic mass to attract major private investments.
- A novel methodology used in this report identifies 6 city clusters with more than 10 million urban inhabitants, and 31 clusters with more than 2.5 million urban inhabitants, based on the location of cities within the road network. Half the city clusters are located inland. This helps to document the changing and diversifying nature of urbanisation in Africa. Inland clusters are likely to develop different economic specialisations from coastal clusters. They offer an opportunity to diversify and connect African economies and to support more balanced territorial development.

Map 2.1. City clusters across Africa

2.5 million urban inhabitants and more



More than 10 million urban inhabitants



Note See Box 2.1 for the full definition of clusters.

Source OECD/SWAC calculations based on OpenStreetMap (2021[1]) and OECD/SWAC (2018[2]).

- While clusters of cities are emerging across Africa, the economic connections between cities in these clusters are still weak. This is partly because most clusters are still very young, and it takes time for economic links to develop. It is also, however, because inadequate infrastructure and barriers to cross-border trade prevent the economies of cities within clusters from developing closer links.
- Even limited border friction can have large effects on the potential for intercity trade. A gravity model of intercity trade based on the primary road network across Africa shows that cities are affected differently by border friction. Border friction is a major limitation on trade in major cities in central Africa that are close to international borders but far from other domestic markets.
- Cities will be major beneficiaries of the Africa Continental Free Trade Agreement (AfCFTA). A large share of African trade consists of resource exports to other regions worldwide, which generates only indirect benefits for urban economies. Strengthening intra-African trade is likely to benefit typical urban sectors, such as manufacturing and tradeable services. Moreover, Africa's cities are large consumer markets, and a reduction in tariffs and other trade barriers is likely to generate a significant consumer surplus, by lowering prices of consumption goods.
- Reducing trade barriers is necessary but not sufficient to strengthen intra-African trade between cities. Good transport links are a precondition for economic exchange between cities, and major investments are needed. Africa has the lowest density of roads of all global regions, both in road kilometres per area and road kilometres per capita.
- Improving intercity transport infrastructure is especially important within clusters of cities. Clusters can only generate positive economic effects, such as borrowed agglomeration economies and network economies, if the cities in the cluster are well connected with each other. Moreover, transport infrastructure provision within city clusters is one of the most effective ways to provide infrastructure. Because it can serve a large number of people and firms, the per capita costs of intercity infrastructure within a cluster tend to be lower than in other parts of a country, while the potential number of users is larger.
- The African road network varies from country to country. This chapter presents new measures for characterising the network across African countries, including the complexity, whether linear or circuitous, of the road network. Some countries, such as Egypt have developed a dense network of direct connections between cities, which is facilitated by its geography. Mountainous countries like Rwanda, by contrast, have only a few, indirect connections between cities.
- Efficient transport systems are multimodal, and road infrastructure alone will not meet the transport needs of the emerging city clusters. African countries need to invest in rail transport to connect cities with each other. As China's experience shows, such investments can have high returns, even at low income levels.

Linking cities to each other becomes increasingly important

Cities are hubs for the exchanges of goods, capital and knowledge. Their economies benefit from the scale that comes with increasing city size, and larger cities tend to be more productive than smaller cities (see Chapter 1). Even large cities, however, do not have the scale in all dimensions that is required to perform at the highest levels. It is thus not surprising that many of the world's most successful cities are part of a cluster of cities. Such clusters can give businesses access to an economic ecosystem of customers, suppliers, investors and innovators much larger than those of a single city. Being located in a cluster can be especially valuable for midsized cities that lack the economic mass to attract major industries.

Africa's unprecedented urbanisation is changing the urban geography of the continent. Not only is the number of urban residents increasing, but the growing number of cities of all sizes has led to the emergence of clusters of cities. In the past, cities in most parts of

Africa were too small and too far from each other to develop intense economic linkages. However, as they have grown, both in size and number, an increasing number of cities are located close to other major cities (OECD/SWAC, 2020[3]). These emerging clusters offer an opportunity to build interconnected economies at a size that can ensure global reach.

Currently, the economic links between cities in Africa are weaker than they could be, even where cities form clusters. Partly, this is because many city clusters have only emerged recently, and because it takes time for their economies to adjust. However, it is also because barriers to economic integration, such as insufficient infrastructure and borders, prevent closer economic connections between cities. Some of the most important emerging city clusters in Africa span multiple countries. Economic connections between them is still impeded by barriers to the free movement of people, goods, capital and ideas. The AfCFTA should facilitate the emergence of economic links between cities.

This chapter discusses the opportunities arising from linking African cities that are close to each other. First, the chapter shows how urbanisation creates clusters of cities, which are common in other parts of the world, but which are a relatively recent phenomenon in most of Africa. These clusters come in a variety of different sizes and shapes, sometimes consisting of just a few intermediary cities within a few dozen kilometres of each other. In other cases, they may span hundreds of kilometres and contain several large and many more small and intermediary cities (e.g. the Ibadan-Lagos-Accra-Abidjan corridor). Second, the chapter shows the trade costs to cities from borders as predicted by a gravity model of intercity trade. Subsequently, it discusses the possibilities for a better integration of cities that arise from AfCFTA. Third, the chapter provides an analysis of complementary policies that are required to link cities with each other, focusing on the role of infrastructure. While city clusters can be identified based on the proximity of cities to each other, proximity is no guarantee that cities will develop economic linkages. Public policies in several policy fields are needed to create such connections, with investments in infrastructure being particularly critical.

City clusters are the backbone of many successful economies

Connecting cities across countries is important for their economies as well as for regional economic integration. Close economic connections with cities in the same country are, however, equally important. Chapter 1 showed that larger cities in Africa perform better than smaller cities and that rural areas benefit from proximity to cities, along a wide range of outcomes. This pattern is evident all over the world, thanks to such factors as: better matches between employers and employees in larger labour markets; greater specialisation of firms in larger cities; a faster spread of knowledge; more efficient delivery of public services; and better utilisation of infrastructure (OECD, 2015[4]).

Not every city can be a major metropolis. However, even intermediary cities can perform the functions and reap the benefits of larger cities by generating so-called borrowed agglomeration economies (Meijers and Burger, 2015[5]) and network economies. This increases their productivity and makes them attractive destinations for businesses. For example, Frankfurt (Germany) is the 495th-largest city in the world, with less than 1 million inhabitants (Florczyk et al., 2020[6]). Nevertheless, it is one of the most important global financial centres, has the world's 15th busiest airport and the third-largest trade fair in the world. None of these economic assets would be viable if Frankfurt were not closely integrated into a polycentric cluster of cities stretching along the Rhine River from Switzerland through western Germany and eastern France to the Netherlands. Consisting mainly of intermediary cities of less than 1 million inhabitants, the region is one of Europe's wealthiest, most populous and economically most important. The interconnected economy of the region allows many intermediary cities in the region to host high value-added economic activities typically found only in larger cities.

Another asset of clusters of cities is that they do not suffer as much from the negative effects of high population levels as large cities do. Land tends to be less scarce within city clusters, for example, because they cover a larger area than a single city of the same size. Even if city clusters cannot replicate all the economic advantages of very large cities, they may still be as productive, because they suffer fewer disadvantages, such as high land prices and congestion.

Clusters of cities exist in various sizes and shapes. Prominent examples of large clusters include the

North-eastern seaboard of the United States, including Boston, New York, Philadelphia and Washington, D.C. The Pearl River Delta in China is a young, but very large, cluster of cities, including Guangzhou, Foshan, Shenzhen and Dongguan. Thanks to China's rapid urbanisation, the region is being transformed from a polycentric system of cities into the largest urban agglomeration in the world, with close to 50 million inhabitants. Small city clusters can also, however, have a major importance for their countries. The two main cities of the Øresund cluster, Copenhagen (Denmark) and Malmö (Sweden) have a combined population of less than 1 million inhabitants. Nevertheless, the cluster is vital for the Danish and Swedish economy. About 20 000 commuters cross the Øresund Bridge daily to work in the city on the opposite site of the Øresund Strait, and the cities and their surrounding region contribute 27% to the combined GDP of Denmark and Sweden (OECD, 2012[7]).

Many of the benefits of close economic integration of cities contribute to economic development because they increase overall economic activity, rather than simply redistributing it from one city to another. The fact that Frankfurt has a major international airport, far from harming cities nearby, offers them exceptional global connectivity, something not normally available to an intermediary city. Likewise, the productivity of cities in the Pearl River Delta is enhanced by the proximity of powerful industrial centres, giving firms access to an unmatched network of suppliers and customers.

Clusters of cities vary in size, shape and function

The morphology of city clusters and the functional connections of cities within these clusters can take many forms. At the local level, cities that are just a few kilometres away from each other often form functional urban areas. Although cities within a functional urban area are morphologically still recognisable as independent cities, they function economically as a single city, for example because they have an integrated local labour market. At larger scales, cities create clusters of various sizes, shapes and scales. A city cluster can consist of a few intermediary cities that are located relatively close to each other or may be a megalopolitan area that stretches over hundreds of kilometres and includes multiple cities with several million inhabitants. It can be monocentric, with one major central city and many surrounding smaller cities, or polycentric, containing several cities of similar size. The cities in the cluster might form a corridor along the coast, along a major road or along an inland waterway. They can be distributed regularly according to historic trading networks, or they can be scattered, without any clear pattern.

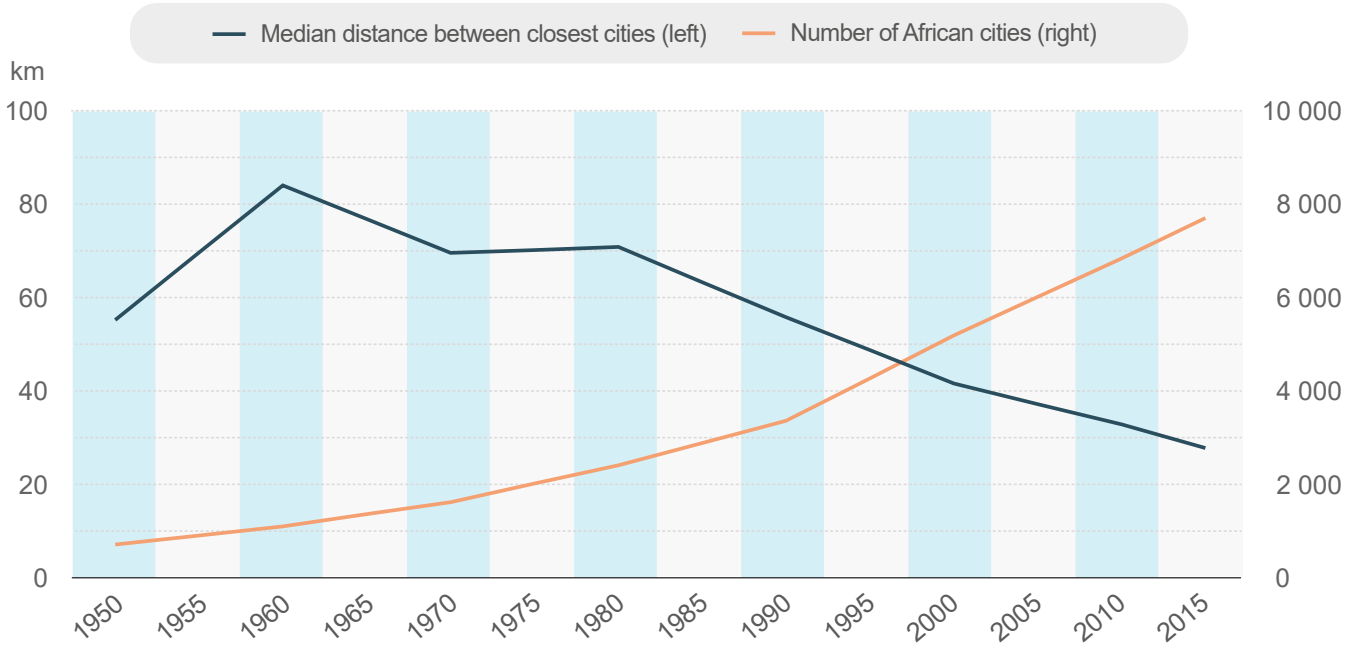
The economies of clusters of cities are equally diverse. Cities in a cluster may rely on the same industry, may specialise in different, but related activities, or have economies fundamentally distinct from one another. Often, clusters of cities emerged due to a concentration of industries that are now obsolete. This can create difficulties, because old urban forms are not ideal for newly emerging economic structures. However, in many cases, city clusters are dynamic incubators for new economic activities and transition more easily to new industries than other areas.

The diversity in terminology describing clusters of cities is almost as great as the diversity in the characteristics of city clusters. The terms city clusters, megalopolitan areas, conurbations, urban corridors, systems of cities and megaregions are all used to describe cities in close proximity. Some of these terms have specific connotations (e.g. *conurbation* refers to cities that have nearly merged into a single functional urban area, whereas an *urban corridor* refers to a system of cities in a linear orientation). None has a widely accepted formal definition, and it is doubtful whether such a definition would be effective. Cities have so many overlapping relationships in many dimensions that it is difficult to make sharp distinctions between clusters.

Urbanisation leads to the emergence of city clusters across Africa

Historically, clusters of cities in Africa have been rare. African cities were mostly small and located far from each other. In 1960, the distance between a city and its closest neighbour was on average 113 kilometres. However, the rapid population growth and associated urbanisation in the last 50 years has drastically reduced distances between cities. The number of cities increased from just above 1 000 in 1960 to more than 7 700 by 2015, while the average distance between a city and its closest neighbour fell to 36 kilometres. A consequence of the rapid urbanisation is the emergence of clusters of cities in many parts of Africa. Although many are still in their infancy, almost all are growing rapidly in population. Some of the larger clusters will turn into some of the world's most populous clusters in the next two decades, if current urbanisation trends continue.

Figure 2.1. Number of African cities and the distance between them



Source OECD/SWAC calculations based on OECD/SWAC (2018[2]).

To identify clusters of cities in Africa, two definitions are applied that aim to distinguish clusters based on size and density. Some clusters are dense, with cities located close to each other, but they potentially do not contain many cities. Other clusters contain a large number of cities but are potentially not as dense, with the cities located at somewhat larger distances from each other. A few clusters are both dense and large. They contain many cities at close distances.

This type of cluster, known as a *compact city cluster*, is defined as a region where at least 2.5 million urban residents live in cities of more than 30 000 inhabitants, within 100 kilometres of each other by road. An *expansive city cluster* is defined as a region where at least 10 million urban residents live in cities with more than 30 000 inhabitants within a distance of 250 kilometres of each other. An expansive city cluster can include one or more compact clusters. A detailed definition is provided in Box 2.1.

Box 2.1. Identifying clusters of cities

This chapter identifies clusters of cities based on their proximity to each other and their combined population size. To show the diversity of city clusters, two definitions are used – one to identify small clusters of cities in close proximity to each other and one to identify large clusters of cities at potentially larger distances from each other. A city might belong to either a small or a large cluster, to both or to neither. However, it cannot belong to multiple small or multiple large clusters.

Definition of city clusters

Compact city clusters

Compact city clusters consist of cities with more than 30 000 inhabitants that are within 100 kilometres by road with a total urban population of more than 2.5 million inhabitants (including their own population). Cities that meet this criterion within 100 kilometres of each other by road are assigned to the same cluster. Cities that do not meet the criteria above, but which are located within 60 minutes' travel of a city that does, are assigned to the same cluster.

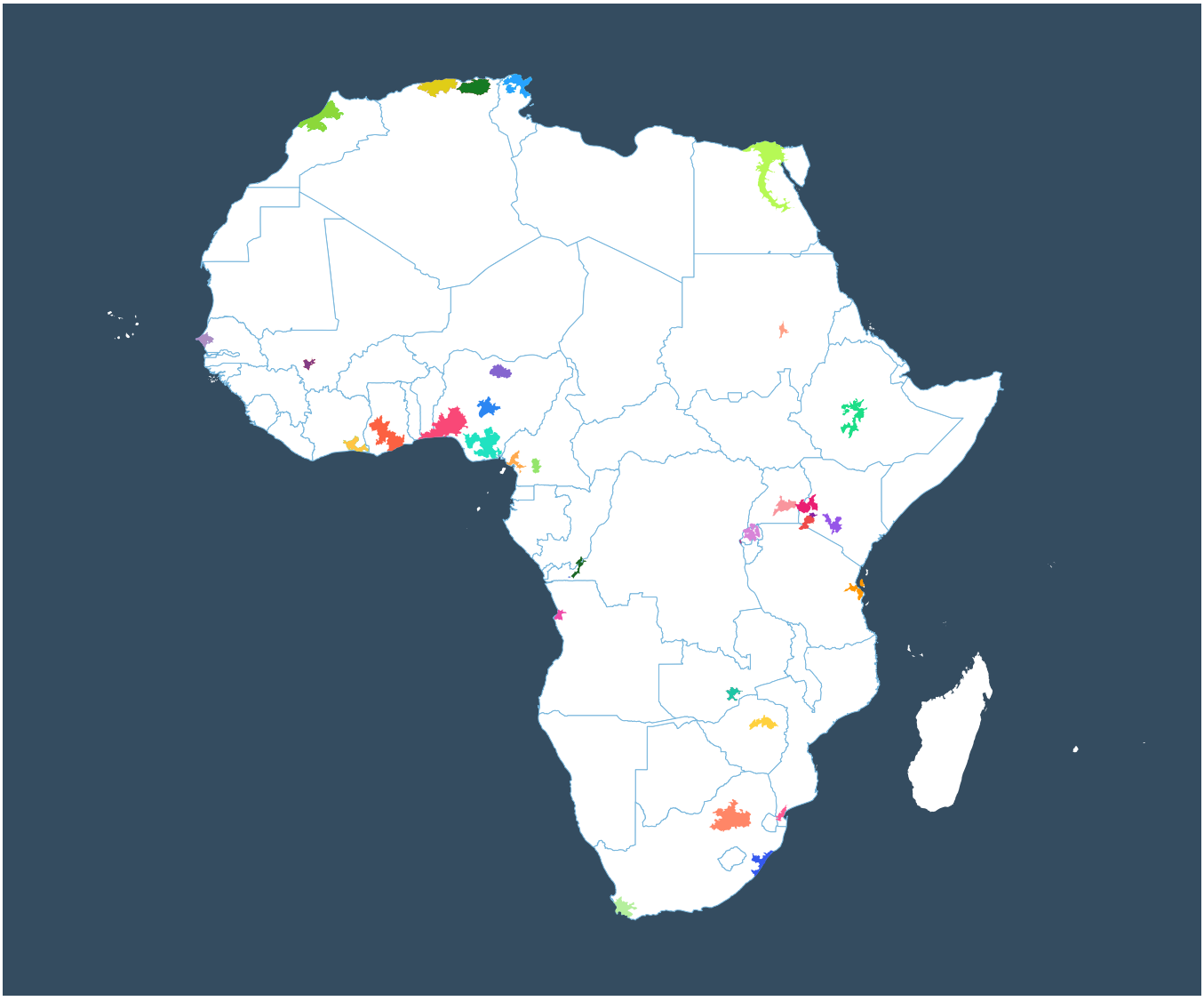
Expansive city clusters

Expansive city clusters consist of cities with more than 30 000 inhabitants that are within 250 kilometres by road with a total urban population of more than 10 million inhabitants (including their own population). Cities that meet this criterion within 250 kilometres of each other by road are assigned to the same cluster. Cities that do not meet the criteria above that are located within 60 minutes' travel of a city that does are assigned to the same cluster.

Across Africa, 31 compact and 6 expansive city clusters exist (Map 2.2 and Map 2.3). By far the largest compact cluster of cities can be found along the Nile and within its delta in Egypt. It is one of the rare examples of a compact city cluster that contains a very large population. With 82 million urban residents, it includes more than 80% of Egypt's population. Besides Cairo, it includes six other cities with more than 1 million inhabitants. The second-largest compact city cluster is a cross-border cluster that contains cities in Nigeria and Benin, in particular Lagos, Ibadan and Cotonou. It is home to 33 million urban residents, even though it has no other cities with more than 1 million inhabitants beyond those three. Another cluster of Nigerian cities around Onitsha, Uyo and Port Harcourt is the third-largest compact city, with 23 million urban inhabitants. Other notable compact city clusters are located around Johannesburg, Kisumu, Addis Ababa and Kinshasa, all of which have at least 9 million urban residents.

Map 2.2. Compact city clusters

City clusters with more than 2.5 million urban residents within 100 kilometres' distance by road

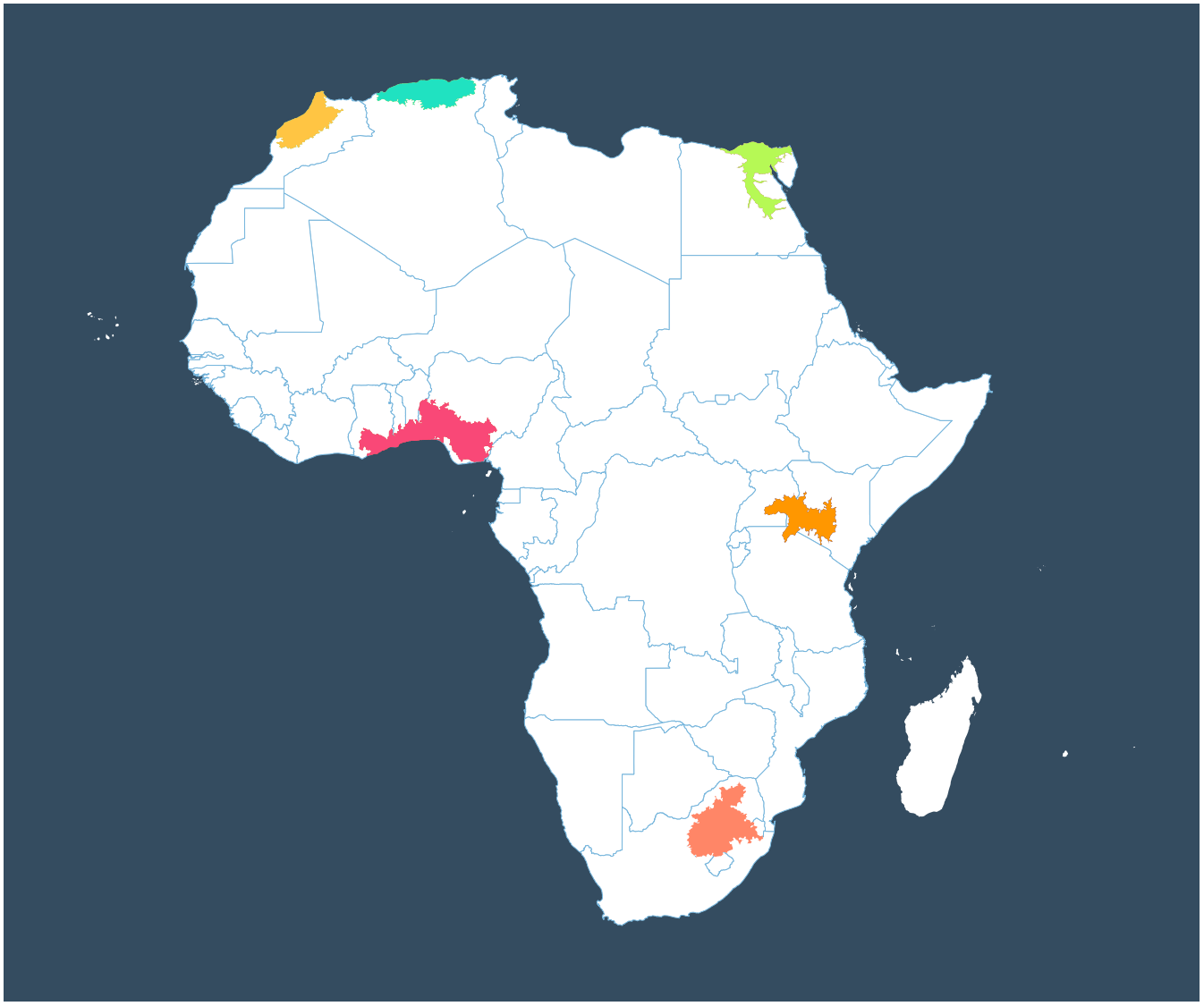


Note See Box 2.1 for details on the definition of city clusters.

Source OECD/SWAC calculations based on OpenStreetMap (2021[1]) and OECD/SWAC (2018[2]).

Map 2.3. Expansive city clusters

City clusters with more than 10 million urban residents within 250 kilometres' travel distance by road



Note See Box 2.1 for details on the definition of city clusters.

Source OECD/SWAC calculations based on OpenStreetMap (2021[1]) and OECD/SWAC (2018[2]).

The largest expansive city cluster covers West African cities from Kumasi (Ghana) in the west, to Kano (Nigeria) in the north and Port Harcourt (Nigeria) in the east form a single cluster of cities, with an urban population of 83 million inhabitants and 15 cities with more than 1 million inhabitants. Within this expansive cluster, several compact city clusters can be found. This shows the importance of considering different scales when thinking about city clusters. In contrast, the population of the city cluster around Cairo remains virtually unchanged, no matter whether the definition for compact or expansive city clusters is used. Under both definitions, most Egyptian cities are included in the cluster, but no cities in other countries are close enough to be part of the cluster.

Another major expansive city cluster, the Nairobi-Kisumu-Kampala cluster, can be found in East Africa. It has 36 million urban residents and six cities with more than 1 million inhabitants. In contrast, the three next largest clusters in South Africa, Morocco and Algeria all have less than half as many inhabitants. A complete list of all city clusters shown in Map 2.2 and Map 2.3 can be found in Annex 2.A.

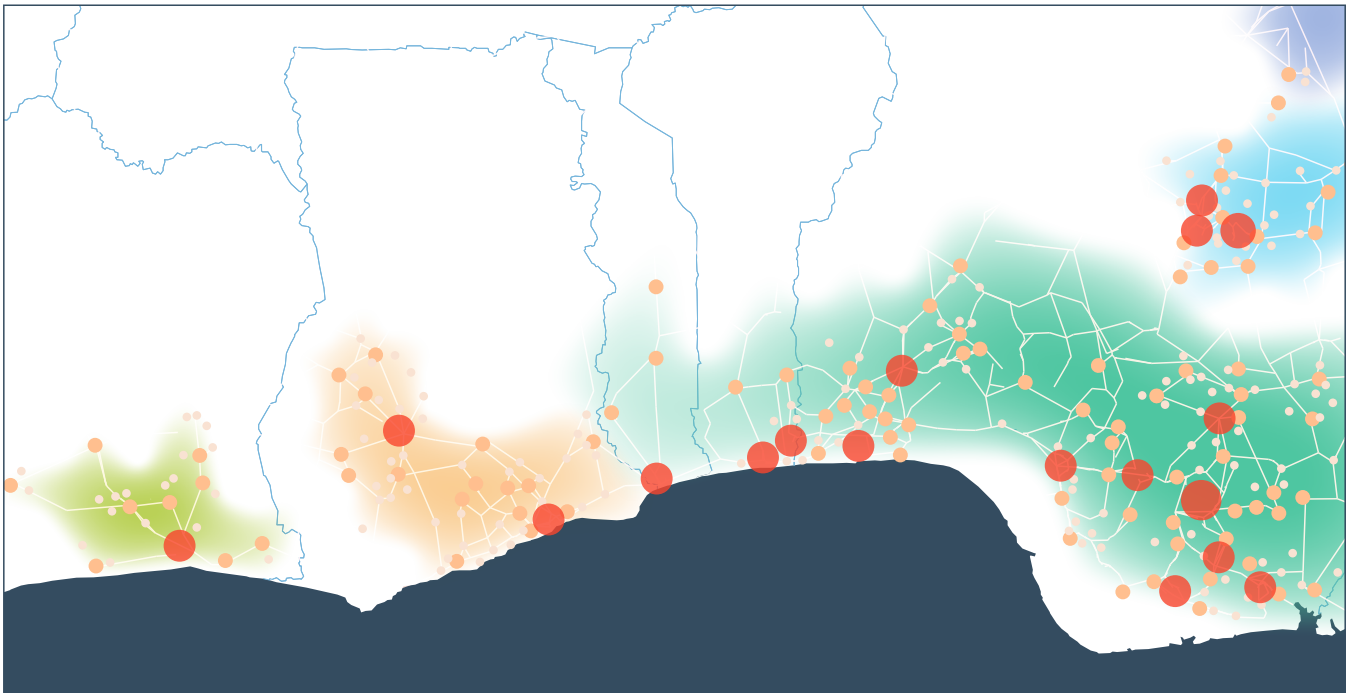
Many of the clusters shown below are still rapidly expanding. If the population of West African cities continues to grow by roughly 50% a decade (the pace in recent decades), the Lagos-Accra-Kano cluster will expand to include Abidjan (Côte d'Ivoire) and will include more than 115 million urban residents. In the same period, another nine compact city clusters are likely to emerge, bringing the total in Africa to 39.

It is important to note that city clusters have been identified based on travel distance, not on functional relationships. Many of these clusters are still emerging, and transport connections between cities tend to be weak. It is likely that clusters do not yet have the type of economic, cultural and social ties found in the most successful city clusters across the globe. Whether such ties emerge will depend on a range of public policies at all levels of government, designed to reinforce intercity links.

Map 2.2 and Map 2.3 document the changing nature of urbanisation in Africa. Half of all clusters are located inland. These are likely to develop economic specialisations different from coastal clusters, for example by focusing on domestic and continental markets instead of global markets, which are more difficult to reach. The growth of inland clusters offers opportunities to diversify and integrate African economies and encourage a more balanced territorial development.

Map 2.4. Compact city clusters in West Africa

City clusters with more than 2.5 million urban residents within 100 kilometres' travel by road



Note See Box 2.1 for details on the definition of city clusters.

Source OECD/SWAC calculations based on OpenStreetMap (2021[1]) and OECD/SWAC (2018[2]).

Reducing border barriers will facilitate the development of urban economies

Some of the most important clusters, in particular in East Africa and West Africa, are cross-border clusters that span two or more countries. The economic development of these clusters is affected by trade barriers. However, even cities not directly on a border are subject to economic costs from barriers to intra-African trade.

Trade across African borders involves a wide range of monetary and non-monetary costs, including tariffs, fees and sometimes bribes. Exporters and importers are required to complete complex paperwork and long and unpredictable waiting times at many borders. The World Bank estimates that across sub-Saharan Africa, exporting a shipment worth USD 50 000 requires average border compliance times of 97 hours.[1] Obtaining and processing the necessary paperwork takes another 72 hours. The costs of clearing border formalities, for example for fees, insurance and bribes (but excluding tariffs), are on average USD 777. Compliance times and costs for imports are even higher than for exports (World Bank, 2019[8]).

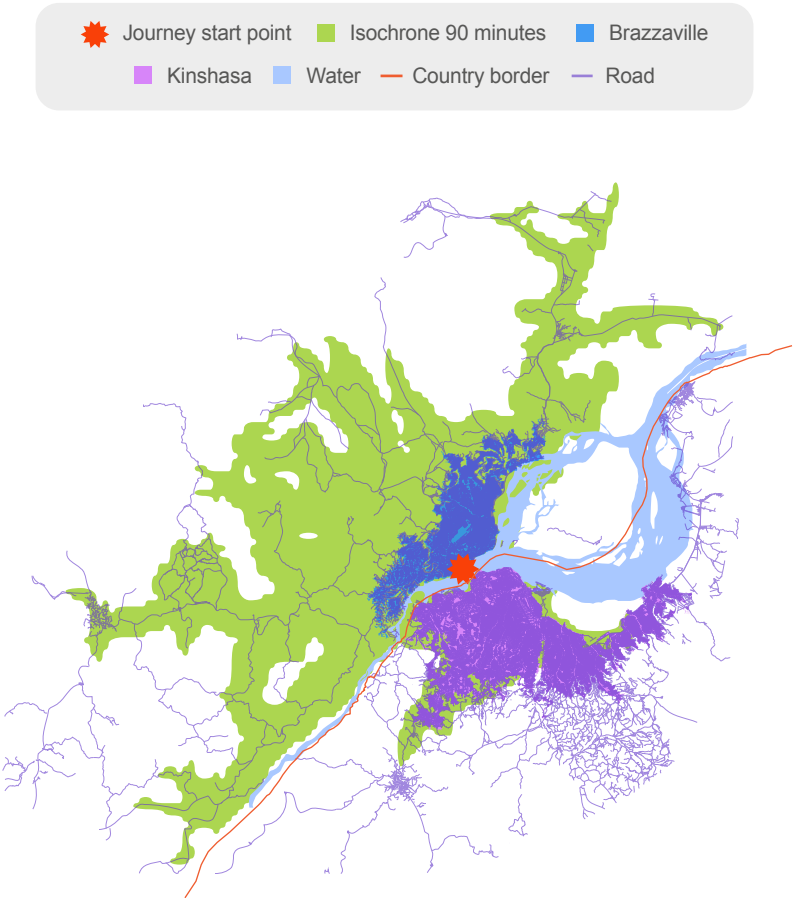
Quantifying the impact of such trade barriers and identifying the most important ones is always difficult, but it is particularly challenging in the African context. A large share of intra-African trade is informal and is not reflected in official statistics. A quantitative study of trade between Benin and Nigeria, for example, found that unregistered informal imports from Nigeria into Benin were roughly equivalent to the registered imports, while unregistered exports from Benin to Nigeria were five times higher than registered exports (Bensassi, Jarreau and Mitaritonna, 2018[9]). Because there is little overlap between formally and informally traded goods, official statistics underestimate not only the magnitude of intra-African trade but the diversity of the goods traded. Shifting informal trade to the formal economy once trade barriers are reduced could yield additional benefits.[2]

In addition to the monetary and non-monetary costs involved in border crossings, the emergence of a pan-African single market is complicated by a wide range of other measures. They include barriers to cross-border investments and capital flows, as well as several dimensions of regulatory policy (World Bank, 2020[10]). While tariffs are often perceived as the key barriers to trade, many of these so-called behind-the-border measures are essential to enable free trade across countries and facilitate the emergence of an integrated market (de Melo and Tsikata, 2014[11]).

Border friction affects cities at different scales. At the local level, they divide border cities and prevent a single functional urban area from emerging. City sections separated by a border function as a smaller city and consequently generate fewer agglomeration economies than the combined city would generate. In many border cities, it is hard or even impossible for residents to secure jobs across the border and for small-scale traders to sell their goods.

The Republic of Congo (COG) and the Democratic Republic of Congo (DRC) offer a striking illustration of the economic impact of borders. The border between them separates two of the largest border cities in the world, Brazzaville (COG), with 1.6 million inhabitants, and Kinshasa, with 7.3 million inhabitants. Although the two cities are separated by the Congo River, almost all Kinshasa would be accessible from the centre of Brazzaville within 90 minutes travel, in the case of no border delays. Without friction at the border and other barriers to trade between the two countries, the economies of the two cities would probably be closely integrated, especially as the languages spoken on both sides of the border overlap. Removing border friction would be even more important than it is today if plans to build a bridge between the two cities by 2028 come to fruition. This investment, in combination with policies to facilitate mobility and trade between the two countries, would allow the two cities to merge into a single urban area. By the time of the planned opening of the bridge, the combined urban area of Kinshasa and Brazzaville would be the third-largest city in Africa, with well over 10 million inhabitants.

Map 2.5. Areas reachable within 90 minutes from Brazzaville (COG)



Note Dark squares indicate areas reachable from central Brazzaville within 90 minutes. The urban area of Brazzaville and Kinshasa is shown in green. The border between the Republic of Congo and the DRC is shown in red. The isochrone is an area accessible within a certain time threshold.

Source OECD/SWAC calculations based on Nelson et al. (2019[12]) and OECD/SWAC (2018[2]).

At larger scales, borders divide clusters of cities. They reduce the market potential of cities and prevent cities from developing the economic links that often emerge between well-connected cities in close proximity. They thus prevent the emergence of so-called borrowed agglomeration economies and network economies that would normally contribute to higher productivity levels in well-connected city clusters (see below).

Even small border costs can cause major reductions in intercity trade

The effects of border friction on trade can be simulated through a gravity model. In such a model, the volume of trade between two destinations is assumed to depend on their economic activity or population size and the travel time between them. Both of these factors have been shown to be strong predictor of trade volumes. To estimate the effects of border friction, a gravity model of trade for African cities has been developed that predicts trade flows between all city-pairs within Africa[3]. To simulate the effect of border friction, the model introduces a necessary delay when crossing a border, of up to 1 000 minutes, and models the resulting decline in intercity trade, compared to a situation where borders can be crossed without any impediments.

While the model incorporates border friction only as time costs, these costs can represent equivalent monetary, regulatory or any other type of costs that firms face in interacting across borders. The modelled time costs are necessarily approximate and cannot realistically reflect the diversity of situations across Africa. The friction businesses face depends on the country, but also on their size and sector.

Map 2.6 shows the African road network without and with border delays. The length of each road segment corresponds to the time required to travel along the road, rather than the distance of the road.[4] Thus, the map distorts the shape of the continent and represents the time it takes to travel between pairs of cities. Roads are displayed in different colours depending on the urban population reachable within a travel time of ten hours. Roads crossing a border are shown in light grey. In a scenario without border delays (left-hand figure), cities in different countries are located close to each other, reflecting the frictionless travel from one country to another. In contrast, introducing border delays (right-hand figure) can be thought of as increasing the distance between countries. As a result, countries become insular, and travel times within a country are much shorter than travel times to neighbouring countries, thus reflecting the difficulty of cross-border travel and trade.

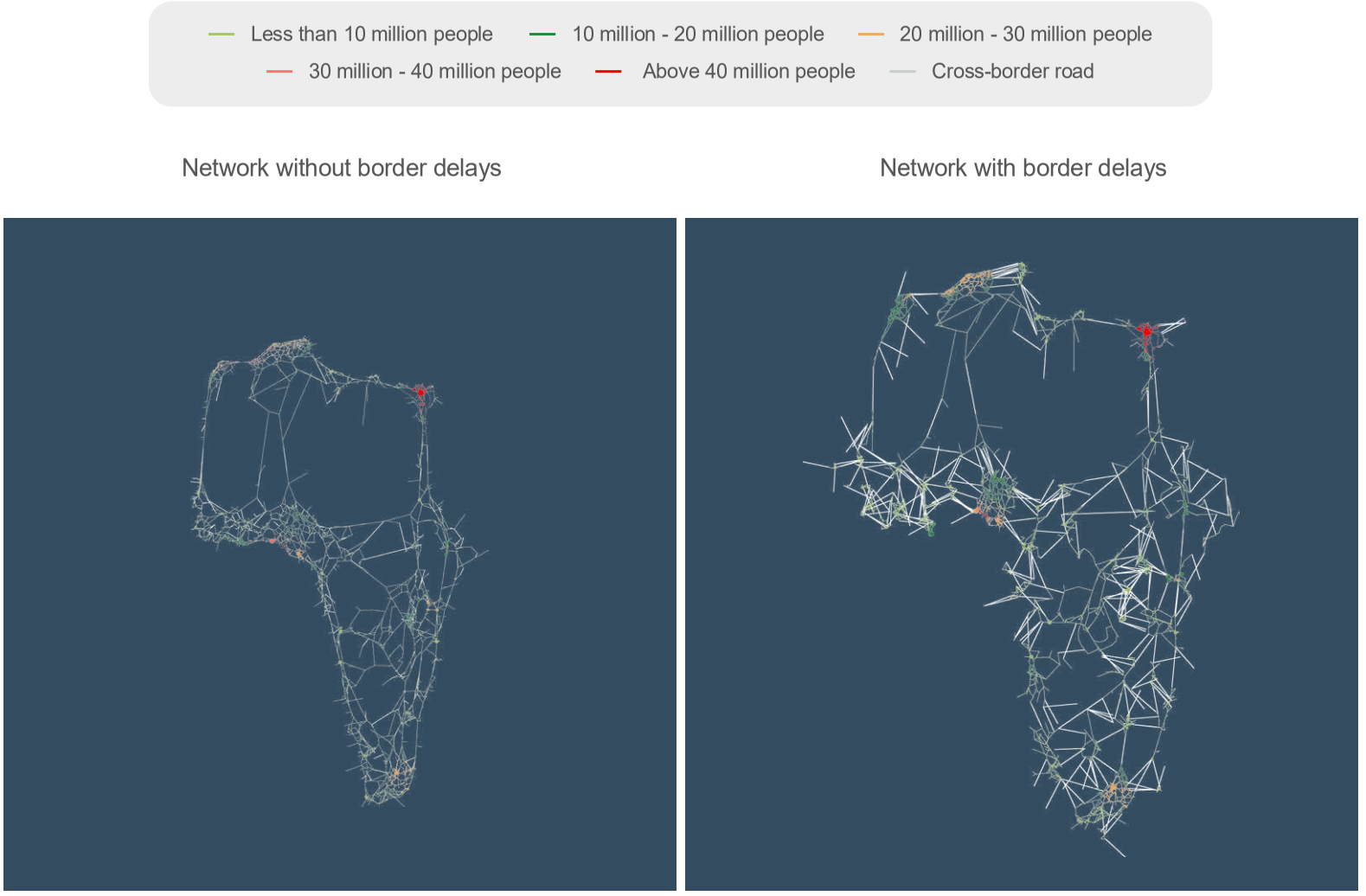
Box 2.2. Analysing the entire primary road network in Africa

Computational advances have made it possible to analyse the road network connecting the majority of African cities of more than 30 000 inhabitants (and all cities of more than 100 000 inhabitants). Road data on major roads (e.g. motorways, trunk roads, primary roads) have been extracted from OpenStreetMap (although the OpenStreetMap data still contains areas with imperfect coverage). An algorithm has been developed to assign cities to the road network and to fill in likely road segments that were not available in the OpenStreetMap.

Each city of more than 100 000 inhabitants is represented by a node in the network that is connected by edges corresponding to major roads. Each urban agglomeration of more than 100 000 inhabitants is assigned to its nearest road coordinates. Then, urban agglomerations of less than 100 000 inhabitants are assigned to its closest road co-ordinates if the distance between a city and a transport node is less than 10km. To preserve the geographical shape of the network, road intersections outside a city are considered to be nodes with no inhabitants. The resulting simplified network preserves the structure of the original road network, by representing each road by a unique edge containing information on the length and travel speed of the original road segment.

Once road data is transformed into a network representation of this kind, it is possible to apply network analysis methods to identify characteristics of the network. The processed network representation of Africa's cities and their connecting roads will be shared with researchers upon request. To request access to the dataset, contact africapolis@oecd.org. Further details on the methodology, and additional analysis, are available in Prieto Curiel et al. (2021[13]).

Map 2.6. The shape of Africa's road network with length symbolising travel time and colours reflecting market potential, without and with border delays



Note The images show a network representation of Africa's road network with roads' colours reflecting different market potential. Market potential is calculated by the size of the urban population reachable within 10 hours travel time. Roads crossing a border are shown in light grey. Roads are shown as linear connections between cities, whose lengths correspond to the required travel time. Correspondingly, road locations are distorted, and the shape of the continent is approximate. The right-hand figure adds a border delay of 1 000 minutes to each road crossing a border. As a result, national road networks tend to be isolated from each other and distances between countries are large. In contrast, no border delay is added to the network shown in the left-hand figure. Countries are much closer to each other and their road networks are better linked.

Source (Prieto Curiel et al., 2021[13]); OECD/SWAC calculations based on OpenStreetMap (2021[1]) and OECD/SWAC (2018[2]).

Even limited border delays lead to substantial reductions in predicted intercity trade volumes, but the effects vary strongly depending on the region (Figure 2.2). The main determinant in modelling the impact of border delays on cities is their location. If cities are close to major cities located across a border, but are far from other domestic cities, the effect of border costs is predicted to be high. In contrast, where cities are close to major cities within their own country, and far from cities located across a border, predicted border costs are low. To account for differences in infrastructure, the model uses travel times between cities derived from actual road links rather than relying only on geographical distance.

Border friction is particularly important for cities in Central African countries. Not only does the region include two landlocked countries, it has many major cities located close to borders and far from other major domestic urban centres. They include Bangui, Brazzaville, N'Djamena and Kinshasa, the respective capitals and largest cities of the Central African Republic, the Republic of Congo, Chad and the Democratic Republic of Congo. All four cities are directly on borders, and constitute some of the largest border cities in the world. The natural trading partners of these cities would be across the border in the absence of any barriers to international trade. Border costs, however, have a significant impact on the predicted trade in these cities.

The average effect of border costs on East African countries is not as substantial as for Central African countries, but it is still high. Several countries, including Kenya, Rwanda, Mozambique and Uganda, are home to cross-border city clusters. Further north is Ethiopia, Africa's second most populous country. Its neighbours, Sudan, Eritrea, Djibouti and Somalia, have major urban centres located close to major cities in Ethiopia. In the absence of border friction, these cities would be natural trading partners.

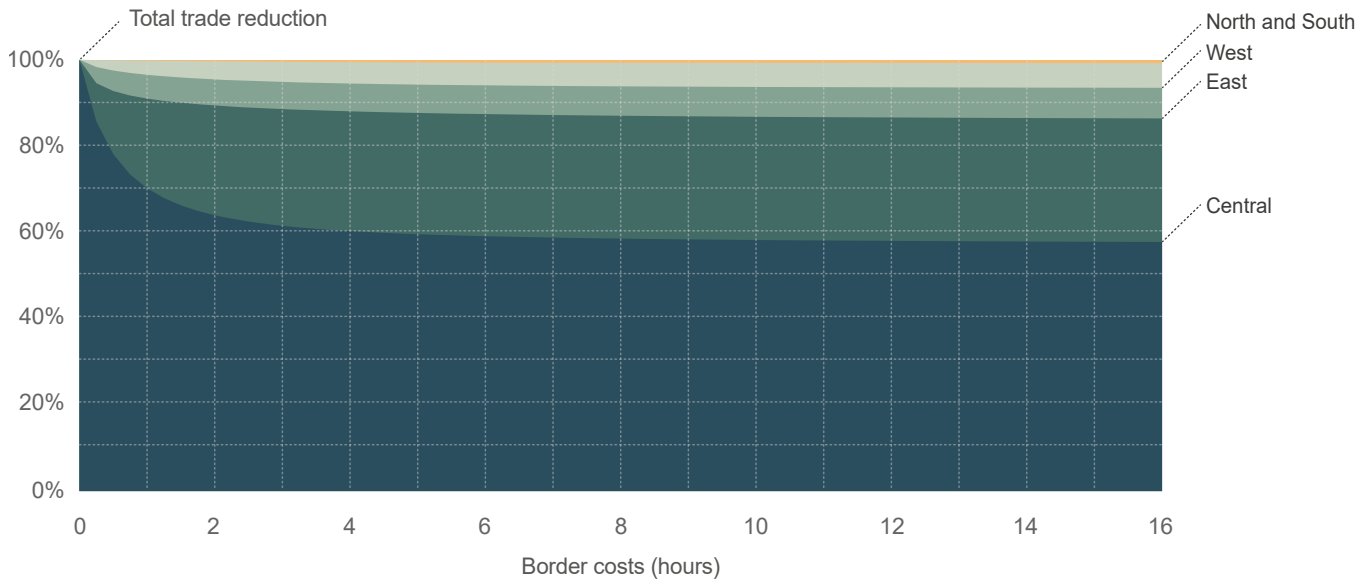
West Africa presents an uneven picture, because the region is dominated by Nigeria, which is significantly larger than its neighbours. The population of Nigeria, Africa's most populous country, is more than six times greater than that of Ghana, the second-largest country in West Africa. Given the size of Nigeria, most of its predicted intercity trade is within its own borders, and border costs are estimated to reduce total intercity trade volumes in the country by only a few percentage points. By contrast, for the smaller surrounding countries, Nigeria is an important potential market. Friction at the border greatly reduces their intercity trade potential. The impact of border costs for those countries is generally predicted to be high.

The situation in Southern Africa is somewhat comparable to West Africa's, in the sense that the region is dominated by a single large country (South Africa), for which border costs are small because most of its intercity trade is predicted to be domestic. Border costs for other countries in Southern Africa are significantly higher, and Eswatini and Lesotho in particular face high border costs. However, their size is so small that this barely affects the regional average. On average, border costs in Southern Africa create only small reductions in intercity trade.

By comparison with most other regions, modelled border costs are comparatively low in North Africa. Due to the geography of the region, most cities are located within domestic city clusters that are relatively far from cities in neighbouring countries. The model thus predicts low levels of cross-border intercity trade, even in the absence of any border costs. As the predicted cross-border trade would in any case be minor, the effects of border costs on predicted trade volumes are small.

The estimated reductions in intercity trade by region are shown in Figure 2.2. While the estimates are informative about general patterns, they should not be interpreted as literal predictions. They depend on the model specifications and on the parameters selected within the model. Actual trade patterns are likely to diverge from those that are modelled, but as systematic information about African intercity trade is scarce, the degree that this might diverge is impossible to verify.

Figure 2.2. Estimated intercity trade reductions for African cities due to border costs



Note Cost of international borders in hours (horizontal axis) against the ratios between the total trade and the trade with no border costs (vertical axis). A detailed description of the methodology used to calculate border costs can be found in Prieto Curiel et al. (2021[13])

Source OECD/SWAC calculations based on OpenStreetMap (2021[1]) and OECD/SWAC (2018[2]).

The AfCFTA creates a basis for regional economic integration

The ratification of the African Continental Free Trade Agreement (AfCFTA) will have profound effects on cities across Africa. Across the globe, cities are transport hubs and centres of international trade in goods and services. As noted in Chapter 1, African cities play this role to a lesser degree than might be expected given their economic advantages over rural areas. The AfCFTA offers cities an opportunity to develop their economies by strengthening international economic links with each other and at the same time to become the pillars of regional integration.

The agreement creating the AfCFTA entered into force on 30 May 2019. Currently, 54 of 55 African Union (AU) member states have signed the agreement, 30 have ratified it, and dismantling the tariffs began in January 2021. The agreement removes tariffs on 90% of regionally traded goods within AfCFTA by 2025, with a reduction of tariffs on an additional 7% of goods over 10 to 13 years in the majority of countries. The modality of trade in services will be the subject of negotiations in 2022 to expand the coverage of the agreement (Tralac, 2020[14]; AU & UNECA, 2020[15]). In addition to lowering tariffs, the AfCFTA agreement contains an annex on non-tariff barriers (NTBs) such as customs and administrative delays, barriers related to technical and sanitary standards, and non-tariff charges on imports, which will have an even greater impact than lowering tariffs (Abrego et al., 2019[16]; AU & UNECA, 2020[15]).

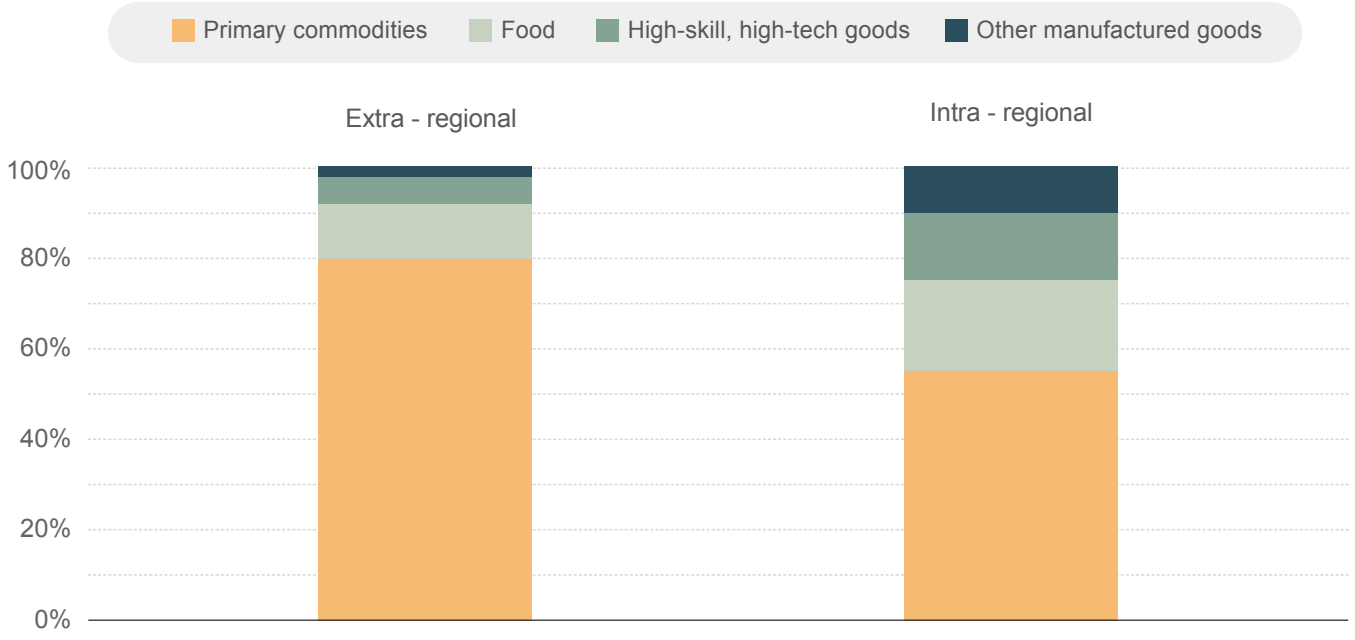
The AfCFTA will bring together a USD 2.5 trillion market with a population of 1.35 billion on a continent that has been fragmented by boundaries, has faced high barriers to internal connectivity, and has a concentration of exports in commodities sectors serving demand outside the region (AU & UNECA, 2020[15]; UNECA, 2022[17]; UNDESA, 2018[18]).

Urban economies will be strengthened by continental economic integration

African cities have been affected by the continent's historical trade structure. Job-poor natural resources exports have crowded out urban jobs, and trade barriers have stymied the competitiveness of exports produced in Africa's cities (Gollin, Jedwab and Vollrath, 2015[19]; Graff, 2018[20]).

However, the AfCFTA can help shift the fortunes of Africa's urban-based exporters. Compared to exports to other continents, which are dominated by commodities, intra-African exports have a larger share of goods and services with value added in cities, such as high-skill, high-tech goods, food and manufactured goods in general (Figure 2.3). Stronger intra-African trade is thus likely to mean a bigger role for cities in the production of traded goods.

Figure 2.3. Composition of exports from African countries to markets outside and within Africa

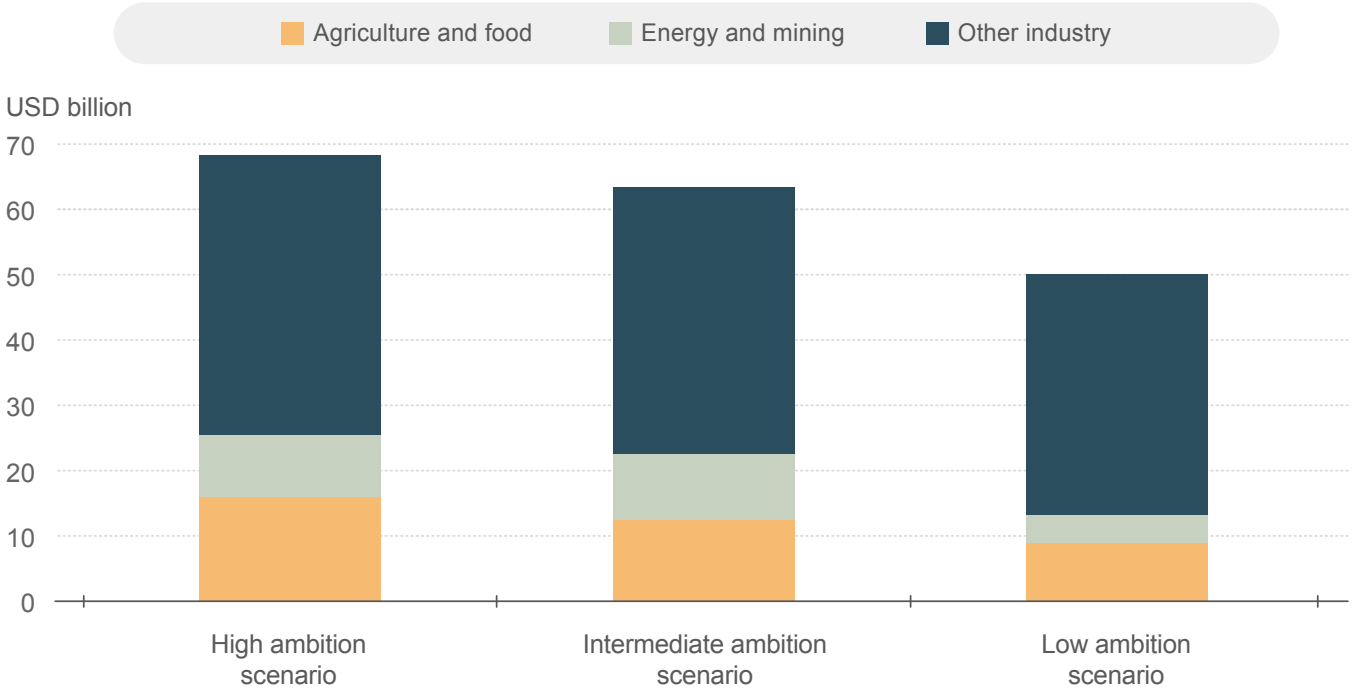


Note Percentage of total African exports

Source (UNCTAD[21]); year of data: 2015-19 average.

The United Nations Economic Commission for Africa (ECA) projections (UNECA, 2022[17]) show major growth in trade in urban sectors, due to the implementation of the AfCFTA (Figure 2.4). Industry (excluding energy and mining) accounts for 66% of the forecast growth to 2040 across the continent. Among the top 10 sectors in terms of total gains in USD are manufacturing sectors typically based in prime and secondary cities: vehicles and transport equipment (USD 8.4 billion increase), metals (USD 8.1 billion increase), machinery (USD 7.6 billion increase), chemical products (USD 5.5 billion increase), other food products (USD 2.8 billion increase) and textiles (USD 2 billion increase). Food and agriculture accounts for 20% of the export growth forecast under AfCFTA (UNECA, 2022[17]), with implications for small and intermediary cities, a large share of whose value added originates in these sectors (Henderson and Kriticos, 2018[22]).

Figure 2.4. Projected change in intra-African exports from AfCFTA by major sectors

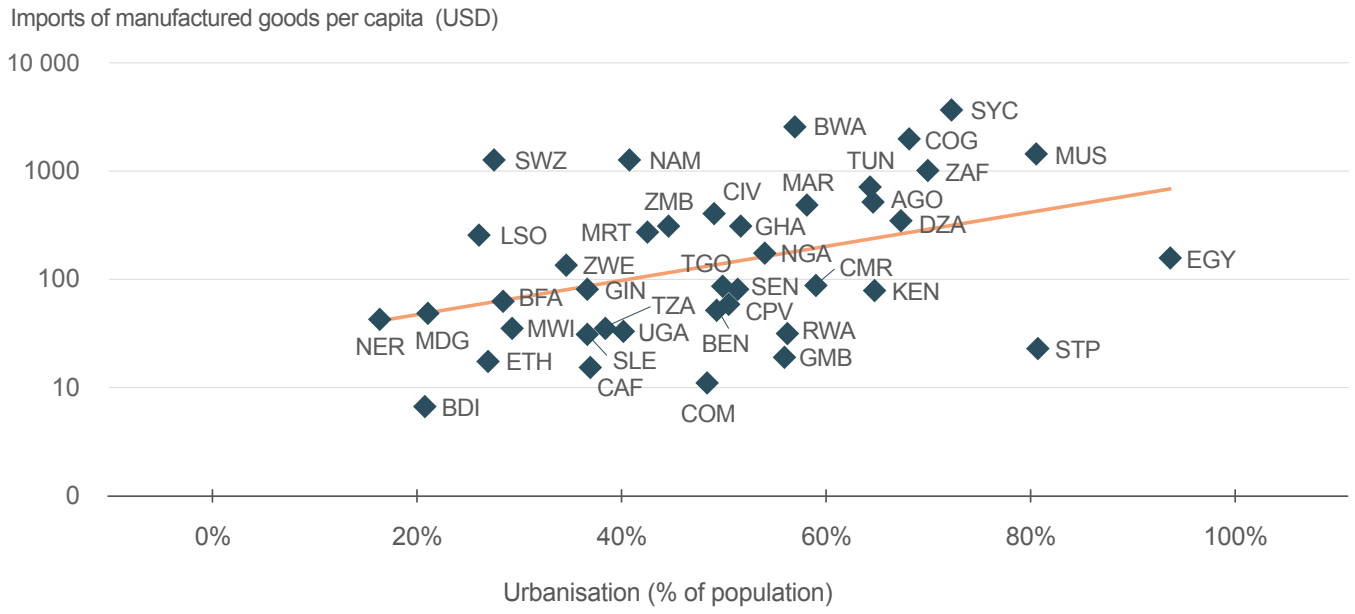


Source (UNECA, 2022[17]), State of Urbanization Report 2021. Cities: Gateways for Africa's Regional Economic Integration.

Africa's cities are major consumer markets that will benefit from lower trade barriers

African cities are also major markets for traded goods, including manufactured goods and food. They are home to Africa's emerging middle classes, with income levels that allow for significant spending on consumption. Although the size of the middle class is subject to debate, it is clear that it is urban. Major cities are the region's consumer markets, due to their higher incomes and sheer population size (Gadzala, 2017[23]; Oxford Economics, 2020[24]). Households in urban areas tend to consume more processed foods and manufactured goods and spend more on housing (UNECA, 2017[25]). Countries that are more urbanised tend to import more manufactured goods per capita (Figure 2.5). Reducing intraregional trade barriers provides a major opportunity for African exporters to tap into this growing urban demand (UNECA, 2017[25]).

Figure 2.5. Urbanisation and imports of manufactured goods



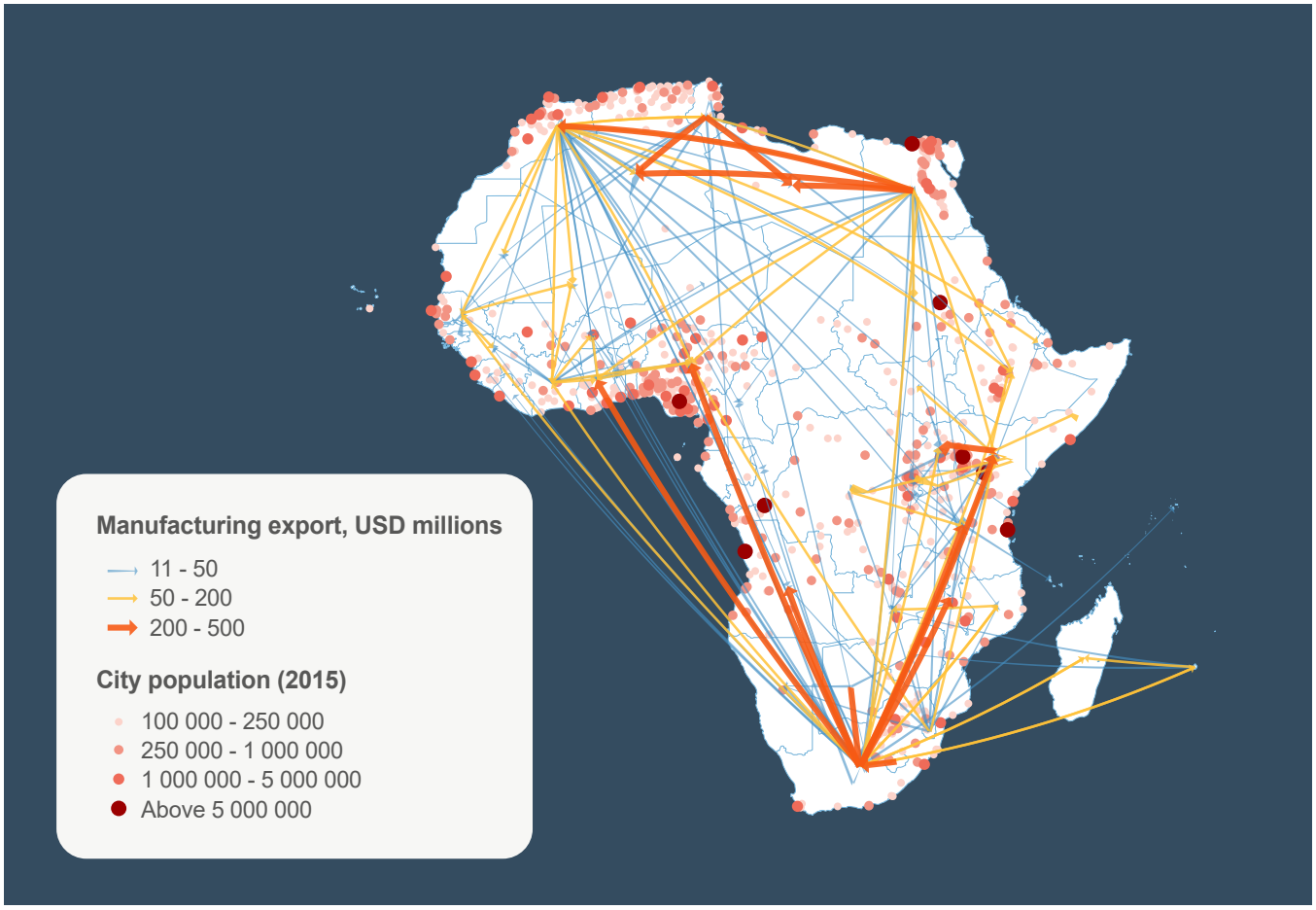
Source (World Development Indicators[26]; OECD/SWAC, 2018[2]).

As the costs of traded goods fall, consumers reap the gains of lower prices (Melitz and Trefler, 2012[27]) and urban consumers are the main beneficiaries, due to their higher consumption of traded goods (Marchand, 2017[28]). This is likely to be the case with AfCFTA implementation, as it is predicted to have a major impact on trade in food, which is central to the budgets of the urban poor. Urban firms also benefit from less costly imports, and there is growing potential for business-to-business intra-African trade and emerging regional value chains, supported by the implementation of AfCFTA (UNECA, 2022[17]).

Major cities that already have a sizeable tradeable sector are likely to see some of the largest gains from intraregional trade integration. According to new economic geography trade theory, production tends to concentrate as transport and trade costs fall. Firms cluster to take advantage of agglomeration economies, especially if they can easily reach cross-border markets with their goods and services (Fujita, 2007[29]). Already most intraregional exports of urban goods arise in a few major trade hubs: South Africa, Nigeria, Egypt, Morocco and Senegal (Map 2.7). Increases in intraregional exports projected under AfCFTA follow a similar pattern, with the three largest economies by total GDP, Egypt, Nigeria and South Africa, together forecast to account for 44% to 47% of total intra-African export gains (UNECA, 2022[17]). These countries have some of Africa's largest urban agglomerations, with cities such as Johannesburg, Cairo and Lagos poised to continue as regional centres of gravity under AfCFTA.

Africa's intraregional urban exports form a doughnut pattern, with the strongest flows around the edges and a hollow centre. Countries also trade more with nearby countries than with countries further away (Map 2.7). North and Southern Africa are each dominated by a single subregional hub (Egypt and South Africa, respectively), whereas the East and West Africa clusters have multiple trade hubs and tend to be more fragmented by national borders. Meanwhile, Central Africa has been largely bypassed by subregional trade flows (UNECA, 2022[17]). However, landlocked countries in Central Africa do stand to benefit from the AfCFTA, as the absence of ports makes them more reliant on intra-African trade (UNECA, 2022[17]).

Map 2.7. Intraregional urban export flows over USD 10 million



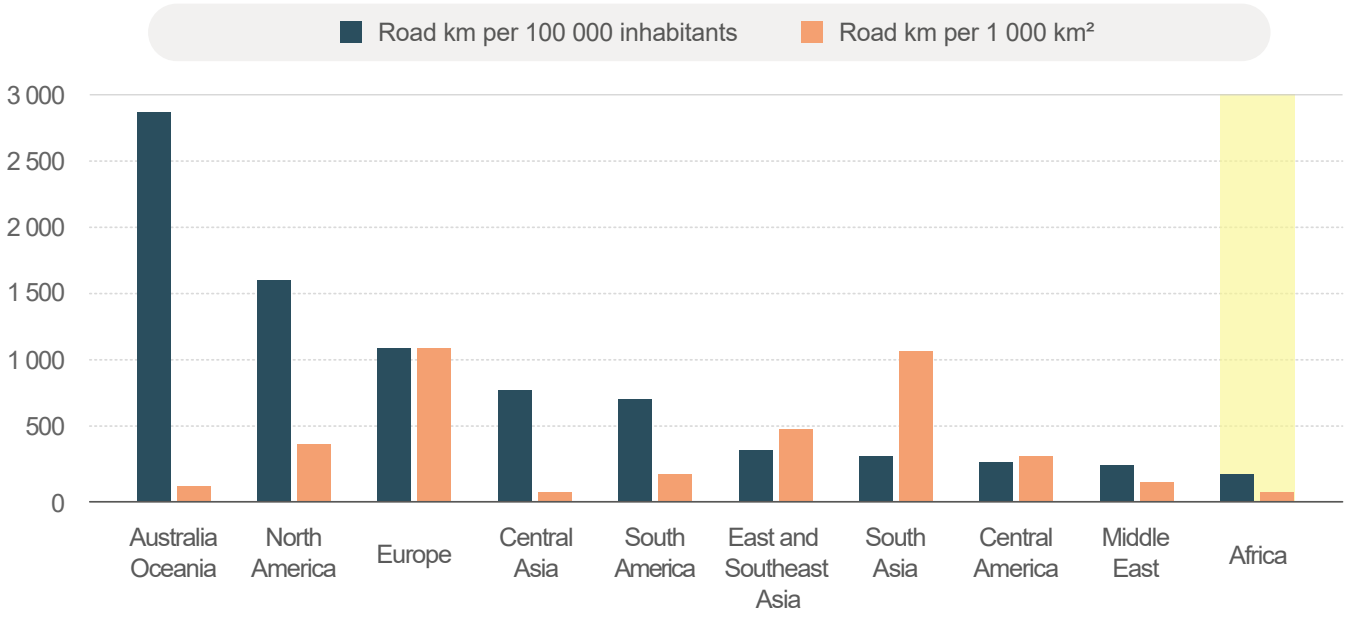
Source ICT TradeMap (exports), (OECD/SWAC. 2018[2]), Africapolis (database); year of data: 2015-19 average.

Large cities will not be the only beneficiaries of regional trade integration. Cross-border trade opportunities are also emerging for small cities to connect with larger urban markets. Trade integration presents opportunities for smaller cities to serve regional markets as trade barriers fall. Small cities may benefit in multiple ways, including their role in the food supply chain serving food-processing firms located in larger cities, increased food demand from consumers in big cities; and finally, potential long-term benefits from e-commerce and distributed economies. Approximately 41 million Africans live in small or midsized cities where the nearest major city of 300 000 or more is across a national border. Of those, about 16 million live in cities of 50 000 or less.

While barriers to international trade are a major bottleneck for intercity trade, reducing trade barriers is not the only measure needed. A key factor in connecting Africa's cities is transport infrastructure. Throughout large parts of Africa, transport infrastructure is insufficient even by comparison with other countries at similar levels of development. This increases journey times for both people and goods, makes journeys unpredictable and generally raises the costs of travelling between cities.

The literature provides considerable theoretical and empirical evidence of the importance of transport costs for urban economies (Storeygard, 2016[30]). While the degree to which transport costs are influenced by infrastructure quality is debated (World Bank, 2008[31]), the need to invest in infrastructure in Africa is undisputed. Of all global regions, the continent has the fewest kilometres of road per capita and per area (Figure 2.6).

Figure 2.6. Road length per capita and per area



Source OECD/SWAC calculations based on CIA (2021[32]).

Successful city clusters worldwide have in common that they are served by high-quality transport infrastructure that connects cities closely. Fast, cheap and convenient flows of people, goods and information between cities facilitate the emergence of interconnected economies that create agglomeration economies and network economies, which in turn initiate a virtuous cycle that attracts further businesses.

The emerging city clusters that have been identified above provide a significant indication of where transport infrastructure investments can yield high returns. Due to the density of population and economic activity in these clusters, roads and rail lines are likely to benefit a greater number of users. Many city clusters have only low levels of transport infrastructure, and investments in such infrastructure are likely to generate high returns. Cities' greater potential numbers of users of transport infrastructure are one of their major economic advantages over rural areas. Unlike in rural areas, transport investments, in a commuter rail line, for example, can thus be economically viable.

However, intercity transport infrastructure will yield high returns only if they are made through an appropriate governance structure that directs investments to where they are most efficient and co-ordinates them with other policy measures (ITF, 2018[33]). While major road investments fall under the purview of national governments, it is important that they be linked to local infrastructure, which is frequently the responsibility of subnational governments. Infrastructure investments need to be co-ordinated with policies outside the transportation sector, such as land use policies (see further discussion in Chapter 4).

A lack of co-ordination between policy sectors and levels of government can lead to a range of unintended consequences. In the 20th century, motorways in high-income countries were often constructed through built-up areas without consideration of their local effects. This led to blight in cities that virtually destroyed entire neighbourhoods, with detrimental economic and social effects for several decades (Lewis, 2017[34]). Intercity transport infrastructure that is not well connected to local infrastructure can equally have negative consequences. It can lead to congestion at the points where intercity roads connect to local roads, or make train journeys inefficient if the railway stations cannot be easily reached from cities.

Box 2.3. New metrics to describe Africa's road network

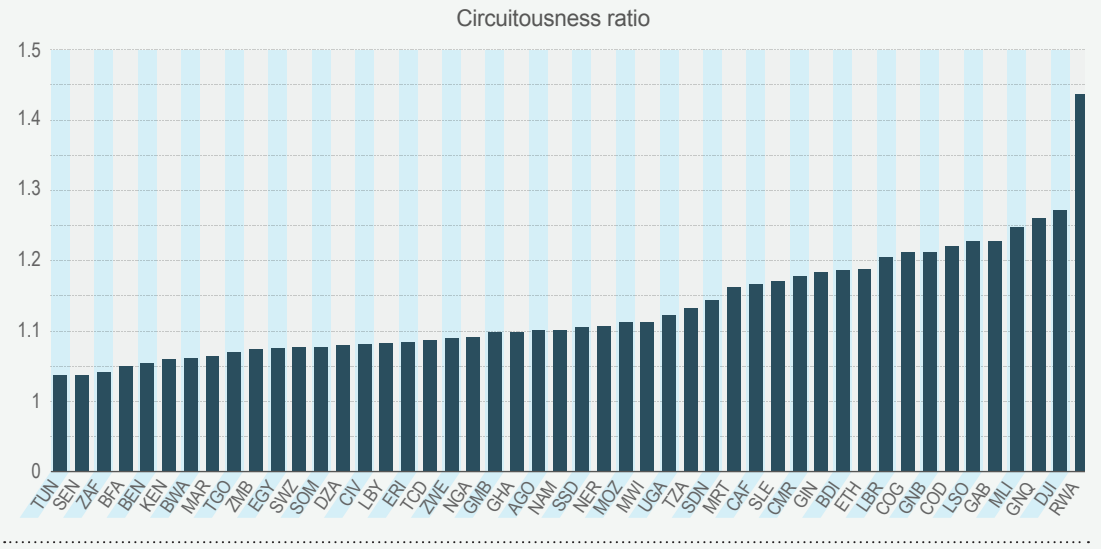
The network analysis that was used above to identify city clusters makes it possible to develop new metrics for the road network of African countries. These measures rely on the relationship between the geographic distance between two cities and the actual travel distance along primary roads between the cities.

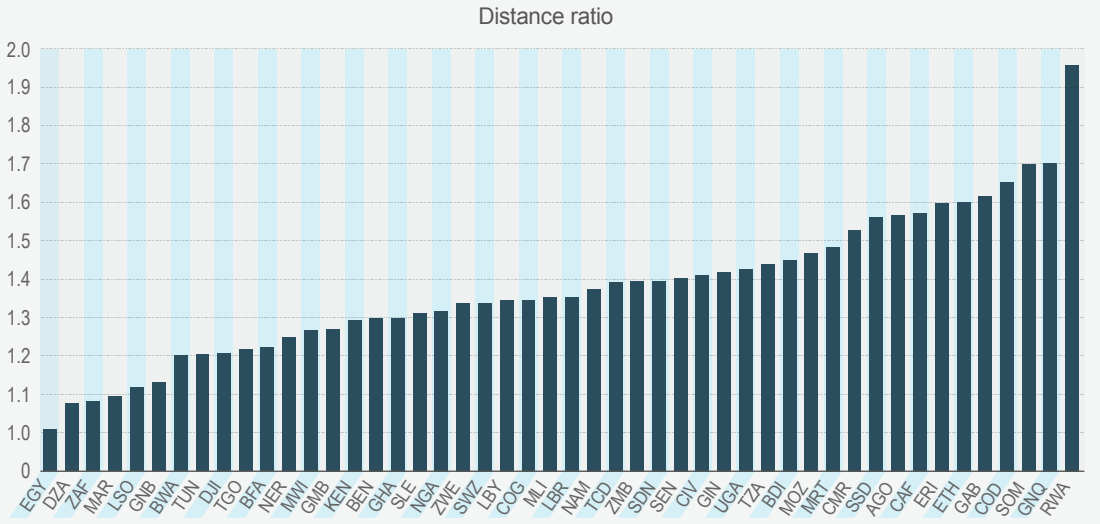
The circuitousness ratio is a measure of whether roads in a country take a direct path or if they make detours to avoid natural obstacles such as rivers or mountains. It is applied to two cities that are directly connected by a road. If the road is perfectly straight, the geographical distance is identical to the travel distance and the ratio between the two is 1. This ratio increases the more a road deviates from a straight line and the travel distance between the cities increases. By computing the ratio for all city-pairs within a country that are directly connected by a road, it is possible to calculate the average circuitousness ratio by country.

The distance ratio is a similar ratio that also takes into account that many cities are not connected by a direct road. Instead of going directly from one city to another, detours via other cities are needed. The distance ratio takes this into account by calculating the ratio of the road distance relative to the geographical distance for all cities within a country, whether or not they are connected by a direct road. The country average of this ratio is influenced by two factors, the circuitousness of the existing roads and the degree to which the road network requires detours via other cities instead of connecting city-pairs directly.

Both measures depend strongly on geographic conditions. Cities located on a flat plain with no major obstacles between them are easier to connect by a direct road than cities separated by a mountain range. Thus, Rwanda, one of Africa's most rugged countries, has the highest values on both indices. Moreover, income levels are an important determinant of the state of the road network. It is thus no surprise that some of Africa's most developed countries, such as Algeria, Egypt and South Africa, have the lowest road-to-geographical-distance ratio, indicating that most of their cities are connected by direct road links.

Figure 2.7. Circuitousness ratio (top) and distance ratio (bottom) by country



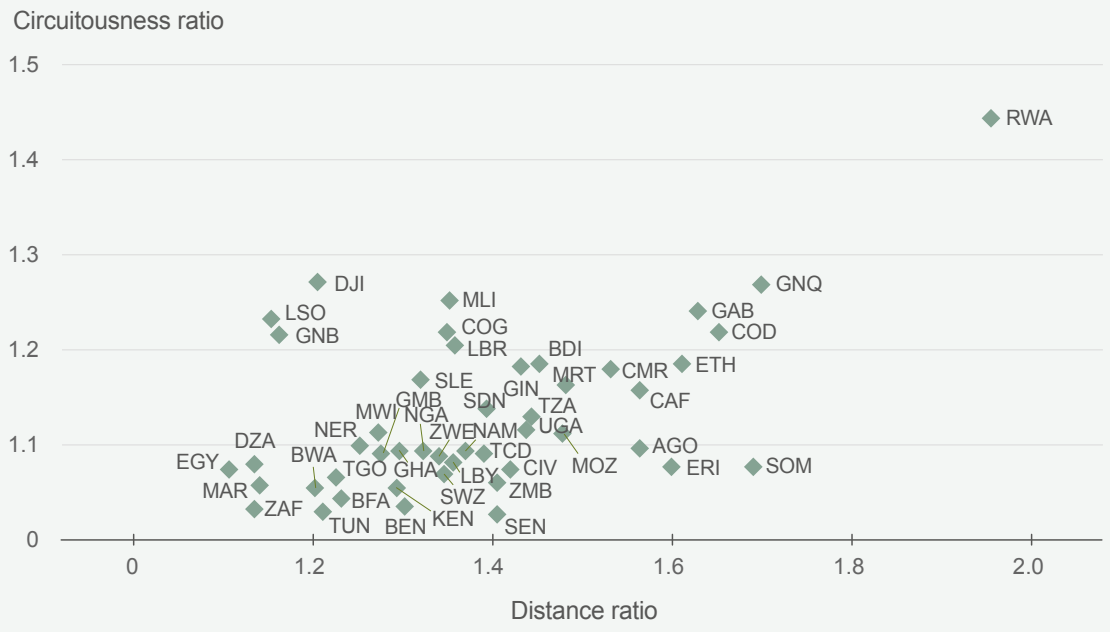


Note The circuitousness ratio is defined as the ratio of the average length of a road and the average distance between the starting and end points of a road. It measures how curvy a road is (i.e. how far it deviates from being a straight line). The distance ratio is the ratio of the average travel distance between a city pair along the primary road network and the geographical distance between the city pair. The distance ratio reflects the circuitousness of roads and also the fact that many city pairs have no direct road connections, requiring detours via other cities (see Prieto Curiel et al. (2021[13]) for details).

Source OECD/SWAC calculations based on OpenStreetMap (2021[1]) and OECD/SWAC (2018[2]).

Figure 2.8 shows the relationship between the circuitousness ratio and the network-distance ratio. Some countries, like Somalia, have a high network-distance ratio, but a low circuitousness ratio. This indicates that the roads in the country are relatively straight, but that many cities are not connected by direct roads, making it necessary to make detours via other cities. In contrast, other countries have a relatively high circuitousness ratio, but a low network-distance ratio. In those countries, many cities are connected by direct roads, but the roads tend to be relatively circuitous. This pattern can also occur in countries where many cities are connected with each other by multiple roads, such as Egypt. Some of these roads might be modern motorways that connect cities directly, thereby reducing the network-distance ratio, while older, less straight roads that exist in parallel increase a country's circuitousness ratio.

Figure 2.8. Relationship between circuitousness ratio and distance ratio



Note A detailed description of the underlying methodology is provided in Prieto Curiel et al. (2021[13]).

Source OECD/SWAC calculations based on OpenStreetMap (2021[1]) and OECD/SWAC (2018[2]).

Good railway links are essential to connect cities within clusters

City clusters have been identified based on existing road links between cities because road transport is by far the most prevalent mode of transport between cities in most of Africa. Other modes of transport, however, are equally important for connecting cities within urban clusters. Rail transport is an essential mode of transport within city clusters. In many countries, it achieves modal shares of well above 50% for intercity journeys at distance of several hundred kilometres (L.E.K., 2019[35]). For example, more than two-thirds of journeys between Korea's largest and second-largest cities, Seoul and Busan, which are located at a distance of approximately 330 kilometres, are made by rail (Matsumoto, Morichi and Acharya, n.d.[36]).

While rail infrastructure may be considered to be of lower priority than road infrastructure, the example of China shows that investments in railways can have high returns. China started to invest large sums in upgrading its existing rail network in the mid-1990s, when its annual per capita GDP was USD 1 100, and it began to build its high-speed rail network in the mid-2000s, when its per capita GDP was approximately USD 2 400. Most African countries reach or exceed these income levels today. To avoid over-relying on road transport, they need to scale up their investments in rail transport at the urban and intercity level.

Rail transport has four crucial advantages over road transport in urban and interurban settings. First, railways have a significantly higher passenger capacity than roads. This is important in cities where large numbers of passengers need to be transported, roads

are congested, and space is scarce. Dual-track railways can carry more than 50 000 passengers per hour (RATP, 2017[37]). By comparison, a single lane of a motorway has a maximum capacity of approximately 2 000 vehicles per hour (National Roads Authority, 2012[38]). Even busy motorways tend to carry less than 20 000 vehicles per lane and day, less than the number of passengers a railway can carry per track in a single hour.

Second, modern railways tend to be the fastest mode of transport between cities in urban clusters. They reach significantly higher speeds than cars and are not affected by congestion. Rail journeys between cities are faster than road journeys, even after factoring in the travel time to and from train stations. Many high-speed railway lines exceed operational speeds of 300 kilometres per hour, including Africa's first high-speed rail connection between Tangier and Casablanca in Morocco (Box 2.3. New metrics to describe Africa's road network). Even operational speeds of less than half that can offer significant time savings over congested road transport connections in large urban clusters. Rail travel also tends to be faster than air travel over the typical distances within city clusters, because airports are often far from city centres and lengthy boarding procedures add to journey times.

Third, rail transport has a better environmental footprint than road transport. Carbon emissions per passenger kilometre of train journeys are between 3% and 24% of the carbon emissions per passenger kilometre in a private car (Department for Business, Energy and Industrial Strategy, 2020[39]). Moreover, rail transport creates much lower amounts of hazardous air pollution than road transport. This is especially important in densely populated urban areas, which are usually more severely affected by air pollution than other parts of a country.

Fourth, increased railway passenger traffic has the potential to reduce the danger linked to road traffic on the continent, with a positive effect on road safety and road-related fatalities. Africa has the highest ratio of road accidents of any continent, with over 23% of global road-related deaths, at a rate of 27.5 per 100 000 inhabitants (World Bank, 2019[40]). Given a total mortality rate of 840 per 100 000 inhabitants, this implies that 3.3% of all deaths in Africa are due to traffic accidents. Shifting road traffic to much safer rail journeys is one option for reducing fatalities.

Box 2.4. Rapid rail is the transport backbone of many city clusters

Japan's Tōkaidō Shinkansen, the world's oldest high-speed railway, links one of the largest global city clusters

The Tōkaidō Shinkansen high-speed railway line is the world's oldest and one of its most successful high-speed railway lines. It connects Tokyo, Nagoya, Kyoto and Osaka, the most important cities of the Taiheiyō Belt megalopolis, whose urban areas have a combined population of 60 million inhabitants. When it was opened in 1964, it allowed for travel speeds of up 210 kilometres per hour, but the line has since been upgraded to operate at speeds of 285 kilometres per hour, making it possible to travel the 515 kilometres from Tokyo to Osaka in approximately 2.5 hours.

Its operating speed is now exceeded by many other high-speed railway systems, but its frequency and passenger volume are still outstanding. In 2016, 365 trains were running on the line daily, carrying 455 000 passengers a day. To increase capacity and reduce travel times, Japan is building a maglev line along the same corridor that can operate at speeds of 500 kilometres per hour. In a first stage, it will connect Tokyo and Nagoya, before potentially being extended to Osaka.

Al-Boraq is Africa's first high-speed railway, linking Tangier to Casablanca

The first high-speed railway line in Africa opened in 2018 in Morocco, and connects Tangier with Rabat and Casablanca. It runs partly on an upgraded existing railway line and partly on a newly built high-speed line that allows for operating speeds of 320 kilometres per hour. The opening of the 323 kilometres of railway reduced travel times on between Tanger and Casablanca from 4:45 hours to 2 hours 10 minutes, roughly half as much as it takes to travel the same route by car. The railway line offers connections every 30 minutes during peak times and hourly connections during off-peak times.

In the first 16 months of its operation, 3 million passengers travelled on the line. Plans for further extensions include the construction of further high-speed tracks along the stretches that are currently operated on upgraded older tracks, as well as the construction of a high-speed railway between Marrakech and Agadir. Moreover, an extension of the commuter rail network within Casablanca is planned, to improve the links of the railway station with the surrounding metropolitan area.

Source (Briginshaw, 2014[41]), International Railway Journal, https://www.railjournal.com/in_depth/shinkansen-half-a-century-of-speed; (Matsumoto, Okuda and Fukasawa, 2018[42]), Method for Forecasting Fluctuation in Railway Passenger Demand for High-speed Rail Services, http://dx.doi.org/10.2219/rtriqr.59.3_194.

Notes

1 These may occur at the border or at other locations, such as warehouses, where export formalities take place and goods are checked.

2 Little systematic information is available on the impact of trade barriers on small-scale trade. This is partly due to the informal nature of much of this trade (Bensassi, Jarreau and Mitaritonna, 2018[9]) and partly to major differences in products, border crossings and shipment sizes. Moreover, costs can accrue in various ways, including lengthy wait times and the need to pay fees or bribes.

3 The technical details of the model can be found in (Prieto Curiel et al., 2021[13]).

4 Travel times are estimated based on road lengths and the road classification (e.g. primary road, secondary road) provided in OpenStreetMap.

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Annex 2.A. Tables
City clusters across Africa

Annex Table 2.A.1. Compact city clusters

Clusters of cities with more than 2.5 million urban residents within 100 kilometres' travel distance

Cluster name	Total urban population	Total population	Number of cities	Cities bigger than 1 million	Total cluster area (square kilometre)	Total built up area (square kilometre)
Cairo-Alexandria-Suhag	81 892 000	92 039 000	1 005	7	73 108	6 344
Lagos-Ibadan-Cotonou	32 988 000	45 629 000	246	3	65 715	5 647
Onitsha-Uyo-Port Harcourt	27 582 000	42 587 000	201	6	54 510	8 393
Johannesburg-Soshanguve-Evaton Central	15 830 000	19 970 000	112	2	55 388	4 141
Casablanca-Rabat-Meknes	10 666 000	14 576 000	40	3	37 336	1 168
Addis Ababa-Sodo-Hawassa	10 582 000	16 019 000	60	3	29 068	4 277
Accra-Kumasi-Koforidua	10 432 000	17 972 000	101	2	47 990	2 681
Kisumu-Mbale-Kericho	9 887 000	12 542 000	22	2	21 379	9 549
Kinshasa-Brazzaville-Mbanza-Ngungu	9 212 000	9 126 000	13	2	7 295	701
Alger-Blida-Tizi Ouzou	7 877 000	12 065 000	85	1	29 825	1 512
Nairobi-Machakos-Tala/Kangundo	7 747 000	11 434 000	21	1	15 440	2 461
Luanda-Sassalemba-Caxito	7 116 000	16 925 000	3	1	5 578	1 011
Kampala-Jinja-Njeru	6 513 000	10 338 000	44	1	17 623	1 561
Dar es Salaam-Zanzibar-Mkwajuni	6 339 000	8 753 000	11	1	11 039	1 305
Khartum-al-Khalas-al-Sururab West	6 076 000	6 038 000	24	1	5 107	1 019
Kigali-Gisenyi/Kisoro-Ruhango	5 835 000	10 921 000	28	2	16 275	1 989
Abidjan-Grand-Bassam-Adzope	5 457 000	5 681 000	30	1	14 388	519
Kano-Wudil-Gwarzo	5 131 000	14,283 000	53	1	17 859	430
Kisii-Bomet-Migori	4 772 000	5 283 000	6	1	9 851	7 686
Cape Town-Paarl Central-Strand Central	4 705 000	5 942 000	27	1	16 818	855
Tunis-Sousse-Nabeul	4 685 000	6 606 000	41	1	23 013	884
Durban-Pietermaritzburg Central-Empumalanga	4 684 000	6 006 000	30	1	13 420	1 445
Dakar-Thies-Mbour	4 378 000	6 726 000	21	1	10 215	436
Abuja-Karu-Gwagwalada	4 123 000	7 044 000	45	1	21 049	868
Yaoundé-Mbalmayo-Obala	4 055 000	4 917 000	6	1	8 637	383
Constantine-Setif-El Eulma	3 966 000	6 607 000	91	0	26 094	666
Douala-Limbe-Buea	3 672 000	4 978 000	22	1	10 364	438
Bamako-Koulikoro	2 845 000	5 443 000	3	1	5 481	515
Cidade de Maputo-Municipio de Manhiça-Vila de Boane	2 836 000	3 167 000	10	1	5 240	1 012
Harare-Ruwa-Marondera	2 723 000	3 677 000	10	1	16 578	900
Lusaka-Kafue-Chongwe	2 613 000	3 682 000	4	1	8 556	718

Note See Box 2.1 for details on the definition of city clusters.

Source OECD/SWAC calculations based on OpenStreetMap (2021[1]) and OECD/SWAC (2018[2]).

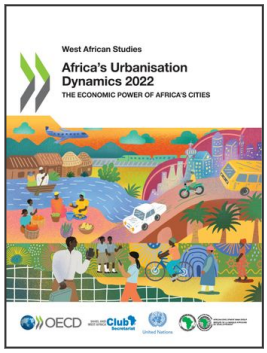
Annex Table 2.A.2. Expansive city clusters

Clusters of cities with more than 10 million urban residents within 250 kilometres' travel distance

Cluster name	Total urban population	Total population	Number of cities	Cities bigger than 1 million	Total cluster area (square kilometre)	Total built up area (square kilometre)
West African Cluster	83 903 000	139 017 000	821	12	321 499	19 169
Nile River Cluster	82 583 000	93 427 000	1 025	7	138 412	6 549
Great Lake Cluster	35 589 000	57 522 000	151	6	155 281	26 862
Algeria Cluster	19 789 000	32 380 000	332	2	138 095	3 470
South African Cluster	19 651 000	27 377 000	236	2	232 890	6 209
Morocco Cluster	15 807 000	26 358 000	107	5	120 991	1 692

Note See Box 2.1 for details on the definition of city clusters.

Source OECD/SWAC calculations based on OpenStreetMap (2021[1]) and OECD/SWAC (2018[2]).



From:

Africa's Urbanisation Dynamics 2022

The Economic Power of Africa's Cities

Access the complete publication at:
https://doi.org/10.1787/3834ed5b-en

Please cite this chapter as:

OECD/United Nations Economic Commission for Africa/African Development Bank (2022), "City clusters, connectivity and economic integration in Africa", in *Africa's Urbanisation Dynamics 2022: The Economic Power of Africa's Cities*, OECD Publishing, Paris.

DOI: https://doi.org/10.1787/46c952e3-en