



CHAPTER 2

New opportunities for global supply chain diversity and sustainability: The comparative advantage of Africa

2.1 Africa: Charting its way through turmoil and crisis

Many factors can influence a company's decision to relocate parts of its supply chain to another country or region, build relationships with new suppliers and gain market advantages for new buyers. A conducive environment for increased productivity, high-growth markets, high-profit entrepreneurship, an active and technology-oriented workforce and a dynamic consumer base will be core factors in making the decision to shift or diversify a firm's supply chain. In many instances, availing of such an environment will depend on a country's stability, its resilience to shocks and its ability to recover sustainably. It is therefore important to understand the current state of African economies and determine whether they can provide opportunities to attract and retain supply chain operations.



A review of the impact of the recent crises on African economies underscores the need for strengthening their resilience to vulnerability and enabling their diversification to achieve greater transformation in line with the Sustainable Development Goals. A recurring theme is the historical overreliance of these economies on commodities and their lack of diversification, as evidenced by good economic performance when commodity prices are high, with consistent reversals of gains when economic shocks occur. The natural resource endowments of Africa, especially of minerals required for the manufacturing and delivery of technology-intensive products and services, continue to be extracted and exported without significant value addition and with limited contribution to resource-based development and industrialization on the continent. Consequently, it is imperative that mining contracts be assessed, and in some cases renegotiated, to ensure maximum revenue for African countries and contribute to a pan-African vision calling for the “transparent, equitable and optimal exploitation of mineral resources to underpin broad-based sustainable growth and socioeconomic development” (African Union, 2009).

This chapter analyses the various economic, market and sustainability dynamics and advantages that countries in Africa can leverage to enhance opportunities for supply chain diversification in the region.

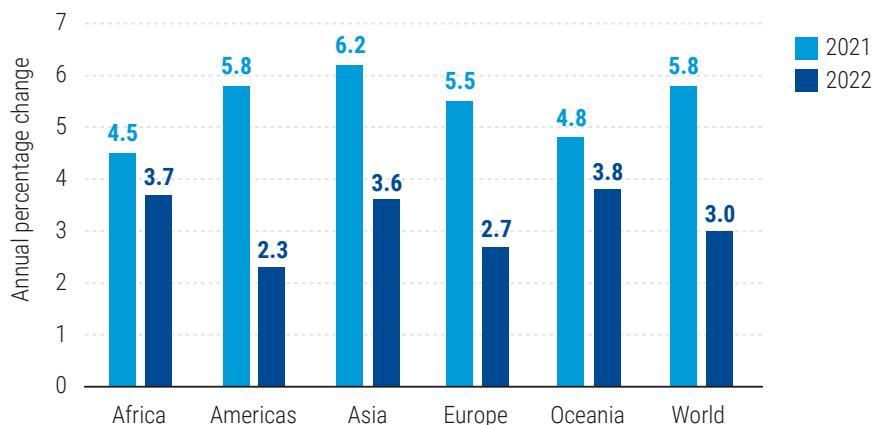
Multiple shocks reverberated across the global economy in 2020–2022: the devastating economic and social impacts of the COVID-19 pandemic; the war in Ukraine, which disrupted the food and fuel supply chain, bringing about inflation; and the ongoing impact of climate change, resulting in a downward trend for gross domestic product (GDP) growth by 2.8 percentage points, from 5.8 per cent in 2021 to 3.0 per cent in 2022 (United Nations, 2023). Africa was not spared, as average GDP growth declined from 4.5 per cent in 2021 to 3.7 per cent in 2022, with subdued output due to weaker demand from developed countries, persistent and lingering effects of the pandemic, high and rising inflation caused by food insecurity and the effects of climate change (figure 2).

However, the average GDP growth rate in Africa masks some variations between regions within the continent. East Africa was the fastest-growing region, attaining 5.1 per cent GDP growth in 2022, with similar forecasts for the medium term (figure 3).

By contrast, growth in the Central Africa region stood at 3.4 per cent, significantly lower than in East Africa. Nevertheless, despite slower growth in Central Africa than in other regions, this was the most rapidly growing region in 2022 compared with 2021,

Figure 2

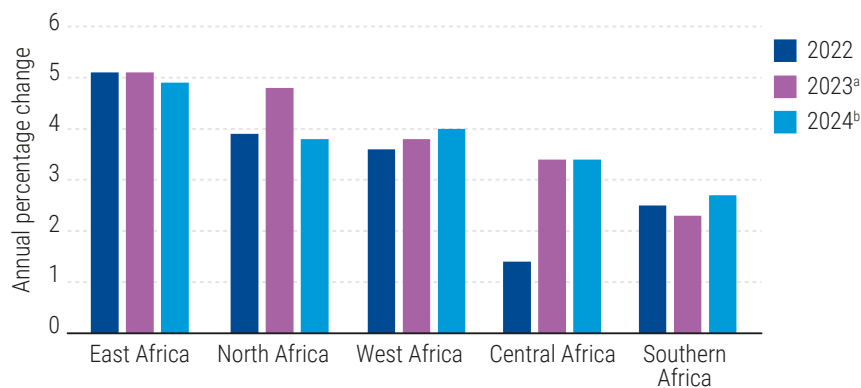
Yearly gross domestic product growth by world region, 2021–2022



Source: UNCTAD, based on data from United Nations, 2023.

Figure 3

Africa: Gross domestic product growth by region, 2022–2024



Source: UNCTAD, based on data from United Nations, 2023.

^a Estimate

^b Forecast

when GDP growth stood at 1.4 per cent. In 2022, growth in Central Africa was attributable to an increase in oil prices, which boosted oil export-dependent economies.

Growth in North Africa declined to 3.9 per cent in 2022, due to low demand in Egypt, drought in Morocco and a contraction in the economy of Libya. West Africa suffered setbacks, as two of its biggest economies, Côte d'Ivoire and Nigeria, experienced subdued growth. Inflation, power supply challenges and lower-than-expected oil production, despite an increase in demand and price, made for lacklustre economic performance in Nigeria (United Nations, 2023).

Southern Africa was the slowest-growing region on the continent, as its largest economy, South Africa, was held back by structural challenges, such as high and rising unemployment and low demand caused by rising inflation, which eroded household incomes. In addition, the continuing power cuts (load shedding) had adverse effects on productivity in industrial and other sectors.

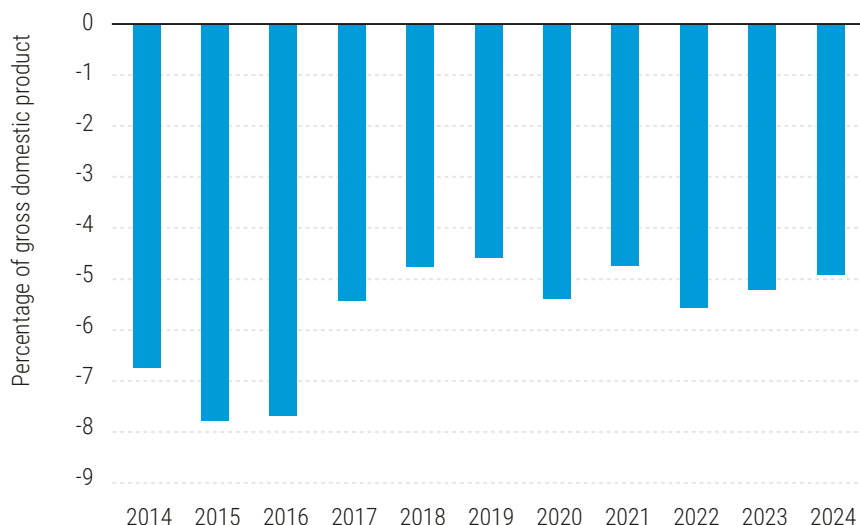
Inflationary pressure, attributable to food shortages caused by the war in Ukraine, had negative, broad-based effects on African countries. Other than Central Africa, where inflation averaged 4.4 per cent, contained partially by rising commodity prices, inflation in all other regions rose to two digits. North Africa had the highest average inflation (25.6 per cent), driven largely by food and fuel inflation in the Sudan, followed by Southern Africa, which saw average inflation rise to 21.0 per cent, fuelled by inflation in Zimbabwe (United Nations, 2023). Inflation is expected to moderate in the near-to-medium term as commodity prices stabilize and inflation from food prices eases.

On average, the current account balance in Africa deteriorated from minus 4.7 per cent of GDP in 2021 to minus 5.6 per cent in 2022 (figure 4), largely propelled by rising commodity prices and resulting trade deficits for net importers of energy and other commodities affected by the war in Ukraine. However, the average current account balance is expected to improve to minus 5.2 in 2023 and minus 4.9 in 2024, underpinned by an expected narrowing of the trade deficit as commodity prices normalize and export opportunities under the African Continental Free Trade Area expand.

However, the aforementioned crises and trade dynamics, in addition to the beginning of trade under the African Continental Free Trade Area, could provide an opportunity for Africa to become a hub for the reshoring of supply chains. The remainder of this chapter provides an overview of the potential of the region as a hub for supply chain diversification and regionalization.

Figure 4

Africa: Average current account balance, 2014–2024



Source: UNCTAD calculations, based on data from the International Monetary Fund, 2022a.

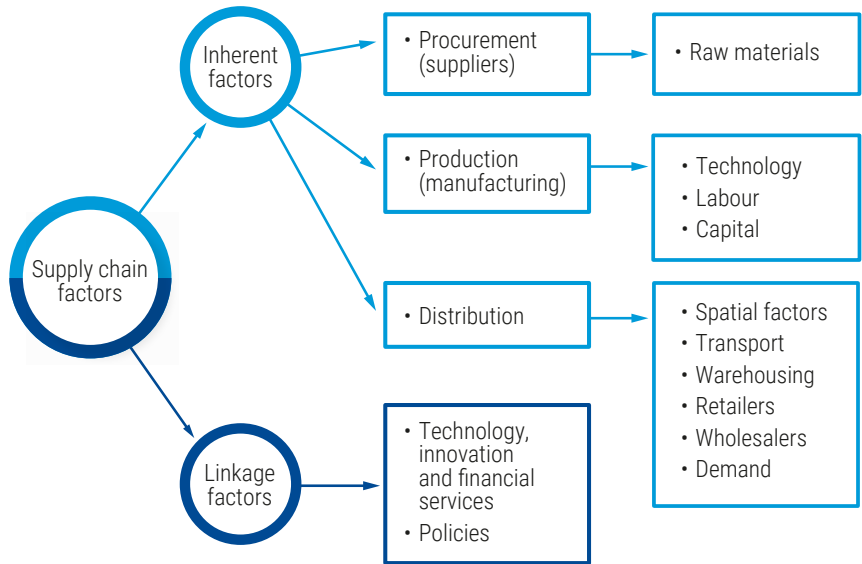
Note: Estimates for 2023 and 2024.

2.2 Opportunities for supply chain diversification: The comparative advantage of Africa

When analysing the opportunities for Africa as an alternative or attractive market for global supply chain diversification, determining the likely outcomes by considering inherent and linkage factors can provide additional insights on the wins and losses companies can expect when making the decision to relocate components of their supply chains to Africa. This chapter will focus on the inherent factors of supply chains, while the linkage factors will be analysed in more detail in chapter 3.

As illustrated in figure 5, the inherent factors of supply chains can be divided into three stages: procurement, production and distribution. Procurement is the process of acquiring raw materials, including sourcing and infrastructure used to acquire the

Figure 5
Inherent and linkage factors of the supply chain



Source: UNCTAD

materials. Production involves the transformation of raw materials into finished products. Distribution is the final stage of the process and involves the movement of goods through a system until they are delivered to the consumer. Distribution is comprehensive and includes transportation, warehousing and retail. It involves the use of soft and hard infrastructure, for instance, and the use of technology in transportation on land, on sea and in the air.

Traditionally, firms sought to manage all three stages of the supply chain from one location. However, over time, supply chains have evolved so that, depending on the industry, different stages can be managed from various parts of the world. For instance, in the automotive industry, it is not unusual for raw materials to be sourced from different suppliers based in different regions. Moreover, some of the global leading car manufacturers have plants on different continents that not only produce different vehicle brands, but also make a variety of car parts (for example, gearboxes and engines) and assemble cars (box 2).

Box 2

Africa: An opportunity to expand the automotive supply chain

Disruptions, the new norm

By mid-2022, motor vehicle manufacturers were debating the effects of the war in Ukraine on the global supply chain. This proved to be a somewhat familiar discussion, after having experienced supply chain disruption as a result of the COVID-19 pandemic. Multinational automotive companies in Europe and North America were no exception, particularly given their heavy footprint in manufacturing cars and car parts and assembling cars in different regions of the world.

There are several opportunities, in particular in the environmental area, for vehicle manufacturers to relocate parts of their supply chains to Africa. As part of their cost-cutting strategies, auto manufacturers have sometimes adjusted their energy mix from largely fuel to a mixture of coal and fuel. African countries are in the process of developing energy-generation strategies and can skew their energy sources to a green mix. Further, in keeping with new legislation, such as the regulation stipulating that all new European Union-based registered vehicles and vans must meet zero emission standards by 2035, Africa offers the necessary raw materials required to produce electric vehicles. Another advantage is that Africa is not encumbered with high-carbon-emitting legacy infrastructure, which opens the door to both green and technology-enabled infrastructure.

Given past supply chain disruptions, manufacturers are advised to broaden their supplier relationships to diminish supply chain risks, including those created by trade barriers. Owing to their proximity to European markets, countries in Africa can offer Europe opportunities to diversify its supplier base and build resilience against shocks to global supply chains.

For instance, investments by European car companies, such as Stellantis in Morocco, to provide parts and components, increased the parent company's resilience when wire factories in Ukraine were shut down owing to the war. Kromberg and Schubert stepped in to close the gap in supply. In June 2022, the manufacturer Stahlschmidt inaugurated first-phase operations of a new \$11 million plant. Similar dynamics are observed in response to the semiconductor shortage. The leading device manufacturer in Europe – ST Microelectronics – already operates a plant in Morocco and invested in a new production plant in 2021.

Sources: UNCTAD, based on Stellantis, 2023; Tanchum, 2022a; Tanchum, 2022b; The North Africa Post, 2018; Volkswagen Group, 2023.

2.2.1 Procurement: Africa poised to be a supplier of critical inputs for the low-carbon transition

Dynamic and complex supply chain processes will require alternative inputs, with low-carbon technologies expected to develop more and more. A World Bank report (2017) considers various scenarios to determine changes in metal requirements for the green energy transition. The analysis finds that in the most ambitious scenario, achieving a goal of limiting the rise in global temperatures to 2°C would increase renewable energy generation to about 44 per cent in 2050, up from 14 per cent in 2016. The United Nations and the Intergovernmental Panel on Climate Change's (IPCC) also predict better economic outcomes if global temperature is held below 1.5°C. For instance, the Sixth Assessment Report of the IPCC (2022) projects economic growth in Africa to be at least 5 per cent higher by 2050 and 10 to 20 per cent higher by the year 2100 if global temperature is reduced to 1.5°C. Notably, the study indicates that renewable energy is more metal intensive than the current energy production, which uses a substantially large component of hydrocarbons. Consequently, a change in the mix of renewable energy to almost half by 2050 translates into a more than twofold increase in demand for the metals used to produce renewable energy. Similarly, the growth in demand for batteries during the transition to green energy in the automotive industry, for example, will likely raise demand for metals used to make batteries (figure 6(a)). In 2020, demand for battery metals amounted to \$12.9 billion. However, such demand is expected to reach \$17.8 billion in 2027 (Statista, 2023). Iron ore (1.6 million tons), aluminium (68,000 tons) and magnesium (30,000 tons) had the highest production levels of all battery production metals in 2020 (figure 6(b)).

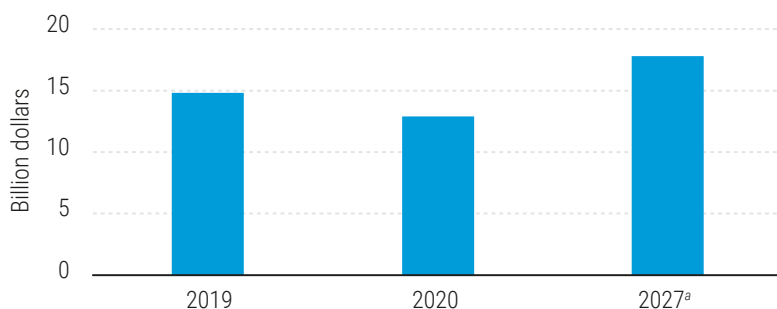
Consequently, there will be a rise in demand for specific metals and minerals with a utility in the low-carbon transition and green mobility. These include chromium, natural graphite, niobium, lithium, nickel, rare earth metals, silver, tellurium and titanium, as well as aluminium, cobalt, copper and manganese, all of which are produced in Africa (UNCTAD, 2022c). Given their abundance on the continent, African economies can play a key role in the supply chain, particularly in procurement, as suppliers of raw materials and metals. For instance, Africa accounts for 47.5 per cent of global cobalt reserves and 47.6 per cent of global manganese reserves, metals that are used to make electrical vehicles (table 2). In addition to cobalt and manganese, Africa holds over 80 per cent of the world's reserves of phosphate rock and platinum group metals.

The Democratic Republic of the Congo alone accounts for about 46 per cent of world reserves of cobalt, one of the main metals used to make batteries, in particular lithium-ion batteries, which are used in mobile telephones, laptops and electric vehicles (figure

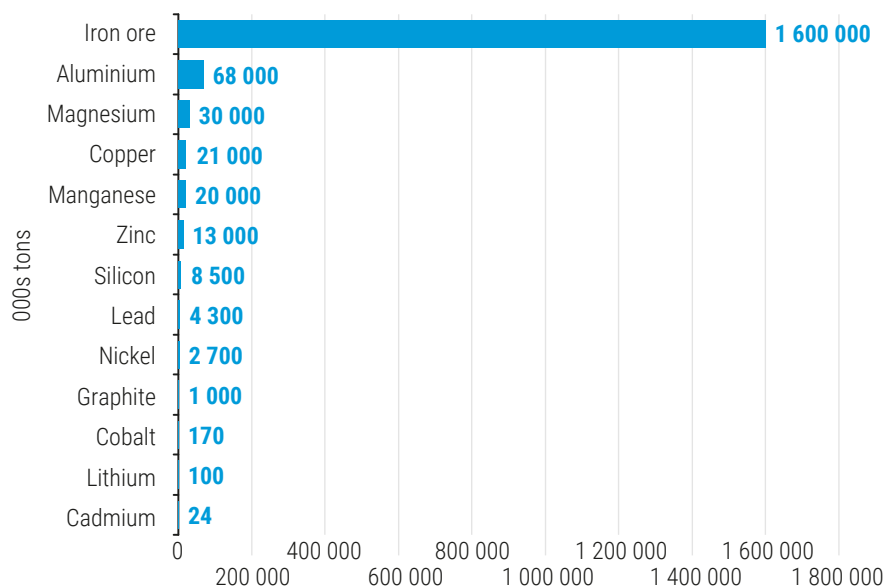
Figure 6

Battery metals production

(a) Market value of battery metals worldwide in billion dollars, 2019 and 2020, forecast for 2027 and



(b) production volume of battery minerals worldwide per 1,000 tons, 2021



Source: UNCTAD calculations, based on data from the 2022 Statista database.

^a Forecast.

7(a)). South Africa is another candidate for a resource-based global supply chain, as it holds about 42 per cent of the world's manganese reserves (figure 7(b)). Manganese and copper are the only two minerals required for the manufacture of batteries for both conventional and battery electric vehicles. While the production of and global demand for electric vehicles are growing, the demand for conventional vehicles will continue to outpace electric vehicles in less-advanced economies, as policies and regulations for electric vehicles have yet to be adopted in those countries.

Another critical metal for the energy transition, with a utility in wind and solar energy and the production of batteries for energy storage, is copper. In 2022, it was the most widely mined metal in Africa. The top producers were the Democratic Republic of the Congo (1.8 million tons) and Zambia (830,000 tons) (UNCTAD, 2022c). Cobalt, mined in the Democratic Republic of the Congo, Madagascar, Morocco and Zambia, had the second largest output in Africa. Cobalt is used to make batteries, as previously mentioned, and generate wind energy. Manganese, which like cobalt has a utility in battery manufacture and wind energy, was the third most commonly extracted metal in Africa, with Zambia, its leading producer.

Beyond exploration and extraction, the Democratic Republic of the Congo and Zambia are potential destinations for refining metal products, an opportunity to lower the costs of transporting bulky, low-value initial extracts. Both countries

Table 2

An overview of critical metal reserves in Africa

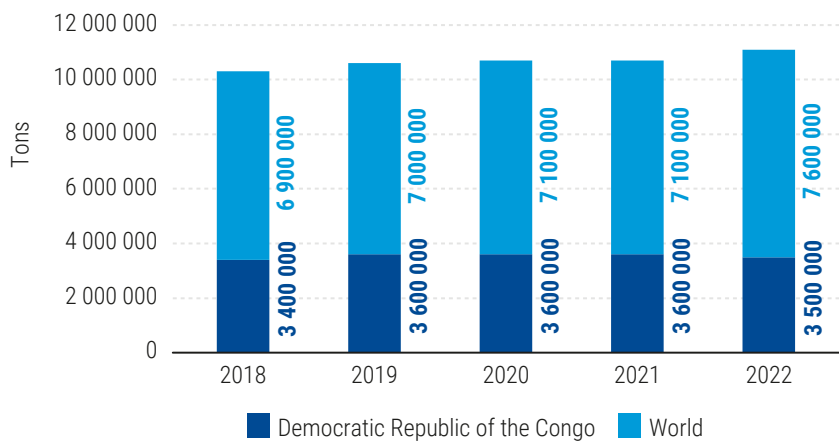
Minerals and metals for electric vehicles	Reserves in Africa (tons)	Share of Africa in global reserves (percentage)
Cobalt	3,653,000	48.1
Copper	52,000,000	5.9
Graphite	69,000,000	21.6
Iron Ore (Crude Ore & Iron Content)	1,670,000	0.6
Lithium	220,000	1.0
Manganese	714,000,000	47.6
Nickel	5,300,000	5.6

Source: UNCTAD calculations, based on data from the Knoema database, 2023.

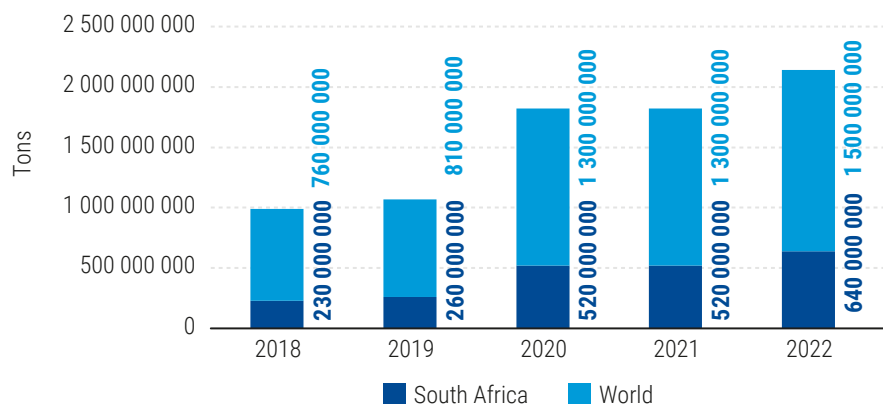
Figure 7

Cobalt and manganese reserves in selected African countries

(a) Cobalt reserves



(b) Manganese reserves



Source: UNCTAD calculations, based on data from the Knoema database, 2023.

make intermediate cobalt products by extraction from copper or nickel ore bodies to minimize shipping costs (UNCTAD, 2020b). For countries such as these, which are vast territories with limited or no access to coast lines, strengthening the metal supply chain to include refining would enhance the supply chain through lower transport costs.

The initial stage of the metals supply chain can be implemented in different locations, depending on how sophisticated the processes are, and whether the capabilities exist domestically. However, proper policies should be in place to ensure ease of operations for supply chains in the production process.

2.2.2 Production: Recalibrating factor inputs for cost efficiency

In general, firms' outsourcing and offshoring decisions are a key determinant for the geography of supply chains. Factors such as distance from domestic markets, production technology and market thickness matter (Grossman and Helpman, 2005). For instance, the farther the distance of the intermediate producer from the home market, the more the cost of outsourcing, with implications for supply chain location. Similarly, production technology (the mix of factors of production – labour, capital and technology) in the intermediate goods market must be similar or more cost efficient than the home market; otherwise it would not make sense to outsource the production of intermediate goods.

After the 2008-2009 global financial and economic crisis, risk became an important factor in outsourcing decisions, resulting in a cathartic shift in the supply chains discourse. Supply risk, demand risk and background risk,⁴ either individually or in combination, have significant effects on a firm's outsourcing decisions, with particular emphasis on the quantity outsourced. In an environment of increased risk (supply, demand and background), risk-averse firms will likely order larger quantities of raw materials and intermediate goods to hedge against future risk (Mukherjee and Padhi, 2022). For instance, commodity prices fluctuated during the Covid-19 pandemic and post-pandemic years (2020-2023). This had an effect on output prices, and inflation rose throughout most economies. During the 2008-2009 global financial and economic crisis, however, background risk was heightened as contagion spread across entire sectors, owing to the closely interconnected nature of markets.

⁴ Background risk is risk arising from external shocks, for example, contagion risk during the 2008-2009 global financial and economic crisis.

As the debate on supply chain resilience progresses, the balance between proximity to supply chains, risks and costs will be important, since resources and finances are finite. In addition, climate-change dynamics will be a central factor, as the type of resources utilized in future production will need to be considered. The following section explores the role economies in Africa could play as intermediate producers.

A macro review of the production process in Africa reveals that capital, followed by labour, human capital⁵ and total factor productivity, was the fastest-growing factor input in low-income countries and lower-middle-income countries between 2000 and 2015 (figures 8a and b; box 3). The sample contains 29 countries for which data were available. Ten are low-income countries: Burundi, the Democratic Republic of the Congo, Mali, Mozambique, the Niger, Rwanda, Sierra Leone, the Sudan, Togo and Uganda. Nineteen are lower-middle-income and high-income countries: Algeria, Benin, Botswana, Cameroon, the Congo, Côte d'Ivoire, Egypt, Eswatini, Gabon, Kenya, Lesotho, Mauritania, Mauritius, Morocco, Namibia, Senegal, South Africa, Tunisia and the United Republic of Tanzania.⁶

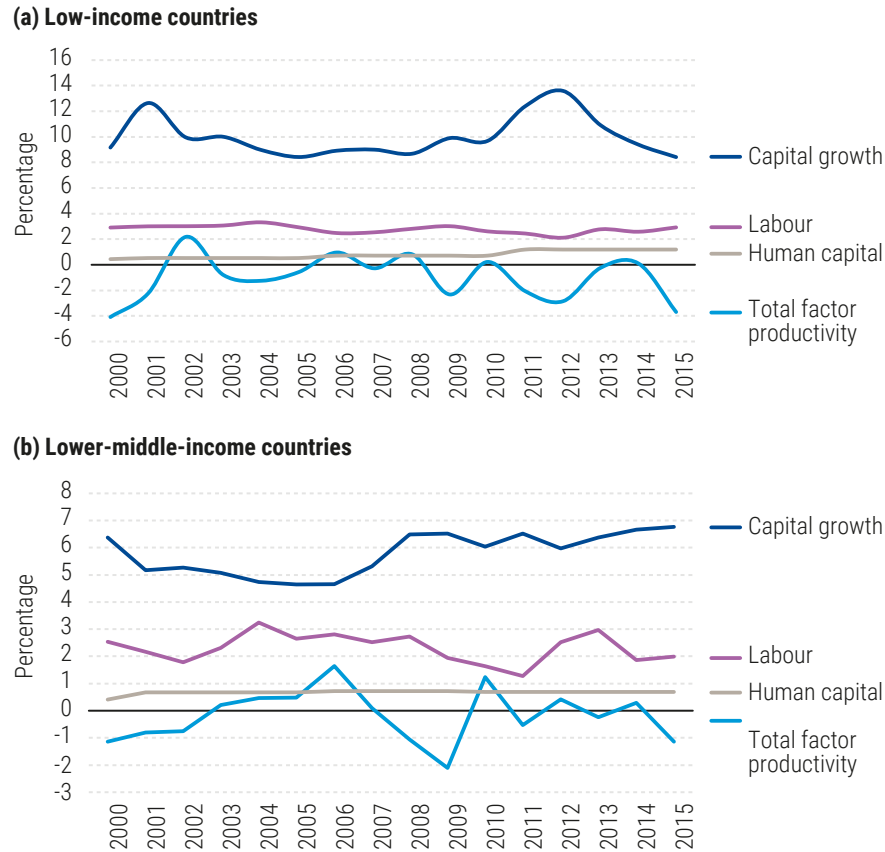
The higher growth rate in capital can be attributed to increased access to financing, especially after the 2008-2009 global financial and economic crisis, as investors sought higher yields outside the United States and Europe (UNCTAD, 2018a). Consequently, African Governments ramped up spending on infrastructure (World Bank, 2019a), while the private sector increased investment spending on plants and machinery.

Accordingly, capital has been the main contributor to output growth, contributing more than twice as much as labour and human capital in low-income countries between 2000 and 2015. The contribution of human capital remained relatively low, peaking at 0.7 per cent in 2015 (figure 9a). In comparison with low-income countries, capital contributions in lower-middle-income countries only represented twice as much as labour contributions in the decade to 2015 (figure 9b). Importantly, the growth rate and contribution to growth of total factor productivity during that period showed a downward trend in both low-income countries and lower-middle-income countries. The slowdown in growth of total factor productivity in the production process contrasts with an increase in total factor productivity in the services sector (for example, financial technology innovations in finance), and the expansion of the services sectors in African economies.

⁵ Data on human capital is derived from the Barro-Lee data set and is limited to 2015. Consequently, the analysis, including that of human capital, is limited to 2015. Nonetheless, the analysis is useful in understanding the evolution and drivers of factor inputs into the production process.

⁶ For the purposes of this report, the countries covered (where accurate and relevant data are available) are categorized by income as per the World Bank classification, as the analysis looks at factor inputs and their contribution to growth, which is likely to be similar for countries in the same income group across other regions.

Figure 8
Growth rate of factor inputs



Source: UNCTAD calculations, based on data from the World Development Indicators database (World Bank).

Box 3**Technical note: Calculating capital stock and technology****Capital stock: The perpetual inventory method**

In the previous section of the report, the contribution of factors of production to output over a period of 15 years (2000–2015) was examined for 10 low-income countries and 19 lower-middle-income countries for which data were available.

First, the perpetual inventory method is used to construct the capital stock data, capital stock in the initial period being a function of capital stock in the previous period as shown below:

$$K_t = (1 - \delta) K_{t-1} + I_{t-1} \quad (1)$$

Where: K_t , which equals capital stock in time t , is determined by previous period ($t-1$) capital stock minus depreciation (δ), and previous period investments I . It is assumed that the depreciation rate is 6 per cent.

Initial capital is calculated from the year 1990. The choice of the year was based on data availability for all countries used in the sample. To estimate the initial capital, the steady state approach is used, that is, it is assumed that capital grows at the growth rate of output. The equation below can thus be estimated as:

$$K_{t-1} = \frac{I_t}{g_{GDP} + \delta} \quad (2)$$

A weakness of this method is that it assumes that the economy is constantly in a steady state, with output growth and therefore capital growth dependent on a single year, whereby in the event of an investment shock in the first year, the capital stock would be biased. Taking note of this bias, five-year averages are thus used.

Contributions to output growth

Once the capital stock is calculated, the next step is to calculate the contribution to output growth, using the Cobb–Douglas production function. The following assumption is made: Capital contributes 40 per cent or 0.4 to total output. Thus ($\alpha = 0.4$) and ($1-\alpha = 0.6$). The Cobb–Douglas production function can be expressed as follows:

$$Y = AK^\alpha (HL)^{(1-\alpha)} \quad (3)$$

Where: Y is total output, K is capital (as calculated above), H is human capital (years of schooling), L is labour, and A is total factor productivity. The function assumes that total factor productivity is a given, that is, exogenous.

The next step is to manipulate equation (3) to calculate total factor productivity (A). Once this is complete, the growth rates of capital, human capital, labour and total factor productivity, are calculated, then the growth rates of capital and human capital and labour are multiplied with α and $(1-\alpha)$, respectively, to obtain the contributions of human capital, labour and capital to growth. The residual after subtracting the growth rates of labour and capital from the growth rate of output, is the contribution of total factor productivity to output growth.

Limitations

The methodology has two limitations. First, as mentioned above, the initial calculation of capital stock at period t depends on the assumption of steady state growth. Second, assumptions are made with regard to the contribution of capital and labour based on the literature. Nonetheless, the methodology is useful as a starting point, as it gives an idea of the factor contributions to output growth for African countries for which data were available.

Source: UNCTAD, based on Berlemann and Wesselhöft, 2014.

Notes: Data relating to investment, GDP and GDP growth are derived from the World Bank World Development Indicators database (gross fixed capital formation). Employment data are calculated based on population data (percentage of total employed over age 15 multiplied by the population over age 15) from the World Development Indicators database.

The evolution of average labour productivity across the whole economy is determined by the interplay between a within-sector component – stemming from capital deepening, technological change, investment in human capital or reduction of misallocation across plants, such as shifting resources from low-productivity firms to more productive ones – and a structural between-change component resulting from labour reallocation across sectors. When workers move to relatively higher productivity sectors, such as manufacturing and modern services, this reallocation gives rise to structural change that promotes growth. However, if these workers leave the agricultural sector but are forced to work in underemployed or small businesses with low productivity, this potential boost in growth does not occur (UNCTAD, 2021a). Labour productivity growth in manufacturing in selected African countries with sufficient heterogeneity in terms of economic development and industrialization is presented in figure 10; this applies the methodology developed by McMillan and

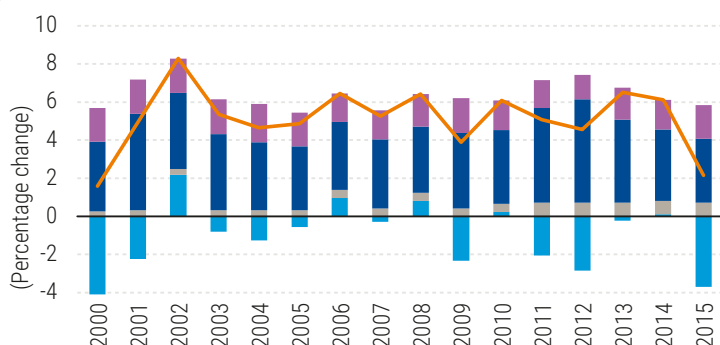
Rodrik (2011) for the period 2001–2019, which coincides with the growth acceleration episodes on the continent.⁷

⁷ The analysis does not include 2020 and 2021, owing to COVID-19-related shocks to these economies.

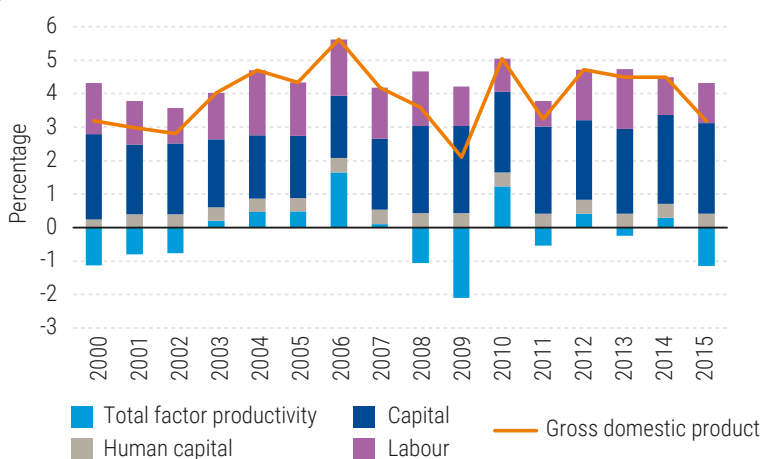
Figure 9

Contribution to output growth

(a) Lower-income countries

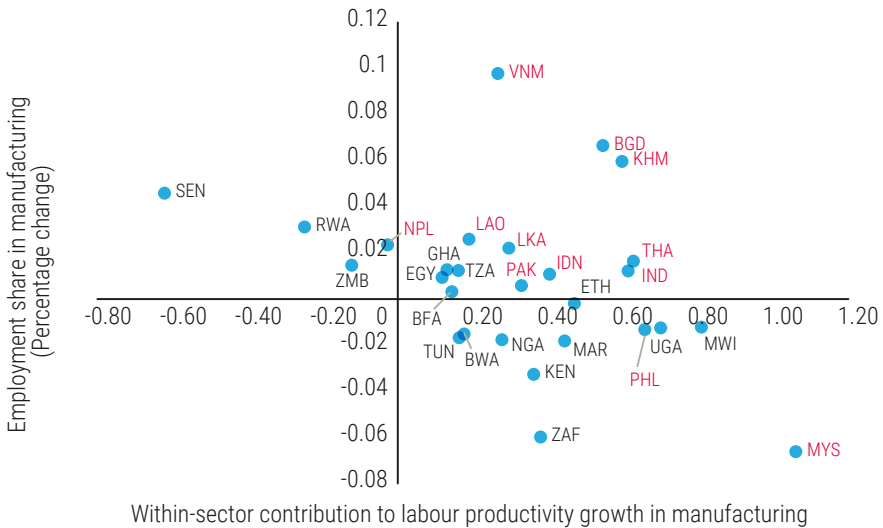


(b) Lower-middle-income countries



Source: UNCTAD calculations, based on data from the World Development Indicators database (World Bank).

Figure 10
Labour productivity growth in selected African countries, 2001–2019



Source: UNCTAD calculations, based on data from the International Labour Organization and UNCTADstat databases.

Note: For the sake of readability, countries are identified by standard ISO 3166-1 alpha-3 codes.

Abbreviations: BFA, Burkina Faso; BGD, Bangladesh; BWA, Botswana; EGY, Egypt; ETH, Ethiopia; GHA, Ghana; IDN, Indonesia; IND, India; KEN, Kenya; KHM, Cambodia; LAO, Lao People's Democratic Republic; LKA, Sri Lanka; MAR, Morocco; MWI, Malawi; MYS, Malaysia; NGA, Nigeria; NPL, Nepal; PAK, Pakistan; PHL, Philippines; RWA, Rwanda; SEN, Senegal; THA, Thailand; TON, Tonga; TZA, United Republic of Tanzania; UGA, Uganda; VNM, Viet Nam; ZAF, South Africa; ZMB, Zambia.

Less than 10 per cent of labour productivity growth, on average, comes from gains from the manufacturing sector. This is surprising, given that manufacturing has historically been a key priority on the region's development agenda, and many African countries have carried out reforms to build a strong manufacturing sector, due to its scope for job creation and, above all, for productivity spillovers to the rest of the economy.

Figure 10 shows that despite cross-country heterogeneity, some commonalities are visible: productivity gains from within-sector productivity in the manufacturing sector have been positive for most countries. Negative within-sector productivity growth is especially unexpected in Rwanda and Senegal, where their Governments have striven to nurture the manufacturing sector. Also, the evidence regarding within-sector

productivity gains on manufacturing does not appear to follow the observed trend in manufacturing employment shares, which could be a reflection of the following factors:

- Industrial upgrading in the capital- and knowledge-intensive manufacturing industries, especially in larger firms (for example, Ethiopia).
- Absorption of labour by traditional and modern services, as well as the construction sector.
- Data for employment estimates might not fully capture formal and informal dynamics in manufacturing where informal employment is significant for the continent. For example, McMillan and Zeufack (2022) show that the rapid growth of small and informal firms could slow down labour productivity growth in manufacturing. Integrating some of the more productive small firms into value chains could have large payoffs.

The results for Botswana and South Africa are as expected, as they have taken major steps to support industrial development through, for example, financial sector and human capital development, trade agreements and partnerships, and foreign direct investment. In South Africa, the most industrialized country on the continent, manufacturing shed labour partly due to increased offshoring activities in ultra-labour-intensive industries, such as textiles, foods and furniture, and to a shift in employment towards modern services, similarly to Botswana. Figure 10 also shows the comparison with selected Asian countries, including Bangladesh, Cambodia, India, the Lao People's Democratic Republic, Nepal, Sri Lanka and Viet Nam. The results show positive within-sector productivity gains in the manufacturing sector and an increased share in manufacturing employment in nearly all Asian countries.

Despite the limited productivity gains in manufacturing for most of the countries during 2001–2019, there are many areas of comparative advantage that the continent can leverage to foster job creation and growth, enhancing industrialization as the global supply chains undergo transformation. The competitive advantage of Africa in its demographic make-up and resource abundance offers potential for investment in industries seeking new consumer markets and that are labour intensive and/or require inputs of raw materials that can be sourced locally, such as critical minerals, which are central to the manufacture of electric vehicle batteries.⁸ Moreover, there is much potential for the African Continental Free Trade Area to facilitate structural transformation in Africa, as the necessary economic and political foundations for the sector are just starting to take hold.

⁸ Lithium, graphite, cobalt, nickel, manganese and rare earth metals.

For firms to consider relocating parts of their supply chains to Africa or outsourcing their production of intermediate goods, maximum gains can be made in recalibrating factors of production, thereby enhancing the production technology while lowering costs. A recalibration of factor inputs, such as substituting labour for capital where possible, in addition to utilizing technology services in the production process, could increase productivity, providing employment opportunities for the large population in the region, a key strength for attracting supply chains onto the continent. For instance, in the automotive industry (see chapter 3), the use of labour, not only in car assembly, but also in the manufacture of some tier-2 car products, could benefit the production process by cutting costs, while also increasing job opportunities for the region's growing population.

2.2.3 Distribution and logistics: Growth opportunities in infrastructure

Within the supply chain, logistics have proven to be the most dynamic component in recent years. For instance, logistics have been disrupted by the development of electronic commerce (e-commerce), largely driven by the growth of firms such as Amazon. The pandemic accelerated the growth of e-commerce, with significant changes to order fulfilment,⁹ warehousing, transportation and time taken to deliver goods to consumers. The more efficient the distribution system, the shorter the supply chain, that is, efficient supply chains reduce costs, which makes trading across longer distances more viable.

The World Bank logistics performance index provides an overview of logistics performance globally, based on six key areas:

- Customs procedures.
- Infrastructure.
- International shipments.
- Logistics.
- Tracking and tracing.
- Timeliness.

The top 10 performers in the 2018 index were mostly European countries, led by Germany. South Africa was the top performer in Africa, followed by Côte d'Ivoire, Rwanda, Egypt and Kenya (figure 11a). South Africa, followed by the aforementioned countries, also took the lead in all six areas. In addition, South Africa, Côte d'Ivoire and Rwanda scored

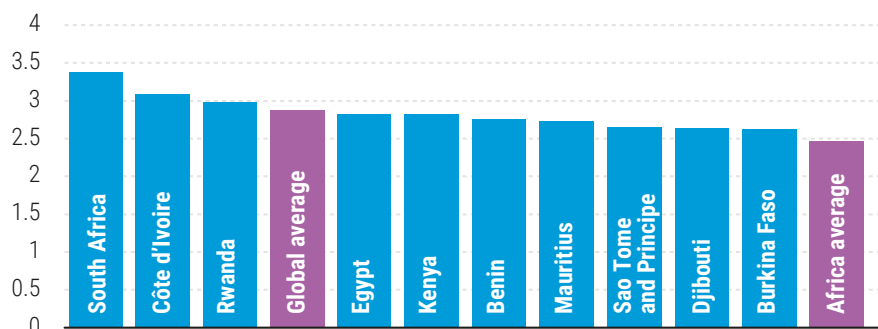
⁹ Order fulfilment is the process an order goes through from the point the order is received by the supplier, to the point it is delivered to the customer.

above the global average of 2.87 in the overall index. In general, the 10 highest-ranked African countries have overall index scores above the African average of 2.46.

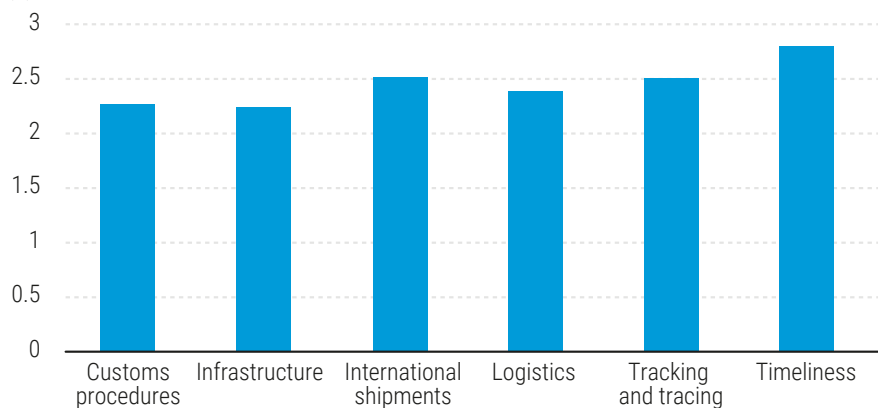
Figure 11

Logistics performance index score, 2018

(a) Selected African countries



(b) Africa as a whole



Source: UNCTAD calculations, based on the World Bank logistics performance index.

Note (a): Some 160 countries, including 45 from Africa, participated in the 2018 logistics performance index.

Note (b): This figure contains the average for African countries featured in the 2018 logistics performance index.

On average, infrastructure received the lowest score in logistics performance (figure 11b). This area includes information and communications technology, railways and road transportation. Information and communications technology scored higher on average than hard infrastructure in the developing countries. Areas such as customs procedures, and tracking and tracing, which are likely to use information and communications technology services, also scored much higher than logistics, for instance (box 4).

While it is important to invest in information and communications technology, it is imperative that African countries maintain investments in hard infrastructure that reduce the cost of logistics in the supply chain.

Box 4

A review of African ports

Exports

The economy of Africa is largely dependent on the demand for commodities from the rest of the world since an increase in demand and in the price of commodities coincides with periods of high economic growth. Trade is therefore essential to its economy. Ports are the main gateway for the region's trade with the rest of the world and are therefore an important aspect of trade facilitation in the African economy.

Nonetheless, of the 54 countries in Africa, 16 are landlocked (Botswana, Burkina Faso, Burundi, the Central African Republic, Chad, Eswatini, Ethiopia, Lesotho, Malawi, Mali, the Niger, Rwanda, South Sudan, Uganda, Zambia and Zimbabwe). Of these, 11 are considered to be commodity-dependent developing countries. Therefore, these landlocked commodity-dependent developing countries are entirely dependent on the infrastructure of neighbouring countries for the export of their commodities (UNCTAD, 2022d).

A PriceWaterhouseCoopers (2018) analysis on ports in Africa finds that inefficiencies associated with inland logistics, infrastructure bottlenecks, port capacity and economies of scale raise the cost of exports. This, in turn, significantly decreases the value received from exported commodities. Port performance is also hampered by a lack of investments. For instance, UNCTAD (2022a) notes that port calls and turnaround times are hindered by congestion at the ports due to limited capacity. PriceWaterhouseCoopers (2018) finds that investment in African ports is often made on an as-needs-basis, which leads to operational inefficiency at the ports, since port capacity is lower than the actual capacity required to handle shipments.

Imports

While African countries are reliant on exports for their economic performance, recent crises have shown that they are also dependent on imports of essential goods, such as food and medicines, and are thus prone to external shocks. For instance, supply chain disruptions due to the war in Ukraine have led to rising food inflation, as corroborated by Carrière-Swallow et al. (2022), with the underlying effect being a pass-through in the costs of logistics.

In conclusion, increasing port efficiency could be a means to lower directly and significantly the value of imports for African countries, especially during periods of economic shock. Moreover, it is imperative that African countries strengthen investments in ports and encourage private sector investments to improve efficiency and capacity that would ensure that more value is gained in African countries from the import and export of goods.

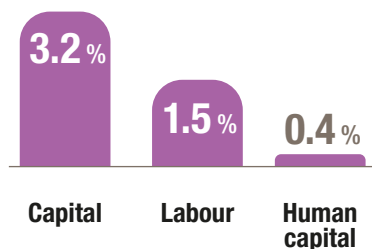
Sources: UNCTAD, based on various sources.

In recent years, efforts have been made to finance infrastructure development on the continent. A notable example is the Programme for Infrastructure Development in Africa, adopted by the African Heads of State and Government at the eighteenth ordinary session of the African Union in Addis Ababa on 29 and 30 January 2012 (African Union, 2012). The aim of the programme is to craft a vision, policies and strategies for the development of priority regional and continental infrastructure in transport, energy, transboundary water, and information and communications technology over the short and medium terms, up to 2030.

The programme contains priority action plans outlining the steps to be taken in the short and medium terms. Priority action plan I covers a list of regional priority projects to be carried out from 2012 to 2020. Priority action plan II was developed with an implementation horizon of 2021–2030.

The focus of priority action plan II is the creation of ecosystems beyond single projects that include integrated economic corridors; global, regional or local value chains; and linkages of urban and rural economies. This plan aims to better prioritize projects by selecting 50 projects (10 per region) that can strategically enhance regional integration on the continent.

Contribution to output growth



Africa's growing and youthful population provides an opportunity for job creation

Consumer economy in the making: Opportunities for supply chains

Africa is one of the youngest and fastest-growing consumer markets in the world. Steady population growth and urbanization will continue to be two of its defining megatrends and will continue to have lasting impacts on every segment of the supply chain. First, African countries are poised to embrace their demographic dividend, given their large young working-age population, only if certain preconditions are in place. Second, African cities are expanding rapidly, and urbanization is often cited as a driver of development, manufacturing growth and a transition from the informal to the formal sector.¹⁰ A growing middle class, youth demography and urbanization are factors that should contribute to making the potential of Africa unlimited.

Population growth in Africa will continue to gain momentum in the coming decades. According to United Nations (2022), more than half of the projected increase in global population up to 2050 will be concentrated in eight countries alone: the Democratic Republic of the Congo, Egypt, Ethiopia, India, Nigeria, Pakistan, the Philippines, and the United Republic of Tanzania, five of which are located in Africa. With the population in Africa forecast to double by 2050 and reach 2.5 billion (about a quarter of the world's population) (United Nations, 2022), demographic growth could bolster future growth potential for consumer markets in Africa, which are increasingly young, sophisticated, globalized and cost conscious. These are important drivers of consumer trends in emerging markets. Indeed, the comparative advantage of Africa lies in its young and growing population, with the pace of technology adoption among African youths accelerating quickly.

¹⁰ While the population in Africa is rising rapidly, economic growth has not kept pace. Consequently, between 2011 and 2022, the average GDP per capita growth in Africa was minus 0.29 per cent (International Monetary Fund, 2022a).

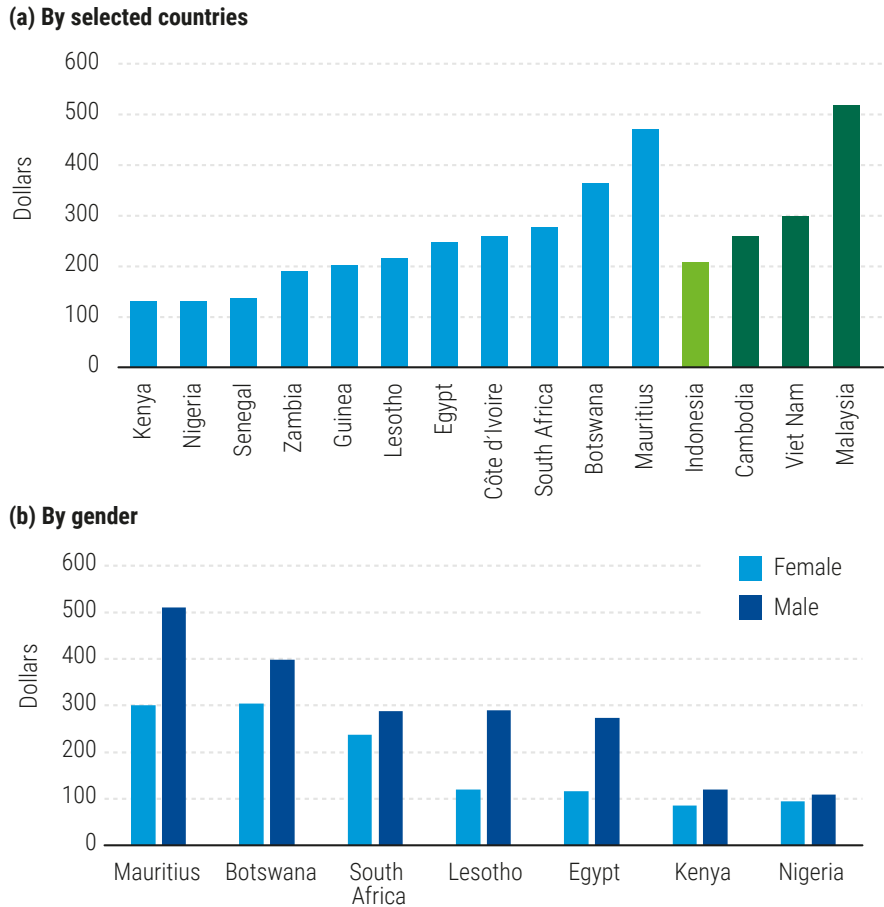
The Global System for Mobile [Communications] Association, commonly known as GSMA, reported 618 technology hubs in Africa in 2019, compared with 442 hubs between 2016 and 2018 (GSM Association, 2019). Nigeria (85 hubs), South Africa (80 hubs), Egypt (56 hubs) and Kenya (48 hubs) recorded the most hubs and are well established as leading technology centres in Africa. The use of technology or high-knowledge-intensive technological services will require active user participation and a feedback loop, with information received from users integrated into services provided (Cunningham, 2021). For instance, according to 2021 figures derived from the 2023 World Development Indicator database, South Africa has a relatively diversified services sector, with a relatively larger share of value added industry to GDP of 24.5 per cent and specialized services in the manufacturing sector (for example, in the automotive industry; see chapter 3).

While some African countries have developed various forms of artificial intelligence (PriceWaterhouseCoopers, 2017), the share of artificial intelligence developed for use in industry and services is still relatively small compared with the rest of the world. Automated intelligence, such as the use of machinery in warehouses to lift, store and assist in order fulfilment, reduces operational costs, while ensuring warehouse safety. The emergence of technology and innovation hubs in Africa may lead to optimal advances in technology adoption, such as artificial intelligence, additive manufacturing (three-dimensional printing), logistics technology and blockchain, and may help lower the cost of supply chains in Africa.

According to the ILOSTAT database of the International Labour Organization,¹¹ average monthly wages in 2019 for plant and machine labourers are relatively low in Kenya, Nigeria, Senegal and Zambia, compared with Asian countries such as Indonesia, Cambodia, Malaysia and Viet Nam (figure 12a). In Africa, wages for plant and machinery labourers are generally much higher for men than for women in four lower-middle-income countries (Egypt, Kenya, Lesotho and Nigeria) and three upper- middle-income countries (Botswana, Mauritius and South Africa), for which data were available. In some countries (Kenya and Lesotho), men earned approximately twice as much as women (figure 12b). This is likely due to gender-specific roles in the manufacturing sector, where women often take on temporary and administrative roles (International Centre for Research on Women and Kenya Association of Manufacturers, 2020).

¹¹ See wages and working time statistics at <https://ilostat ilo.org/resources/concepts-and-definitions/description-wages-and-working-time-statistics/>.

Figure 12
Average monthly earnings in selected African countries and by gender, 2019



Source: UNCTAD calculations, based on data from the ILOSTAT database (International Labour Organization).

The middle class in Africa is also expanding. Although there is no uniform measure of the size of the middle class in Africa, the overriding consensus is that it is growing rapidly. To gain a better understanding of this issue, this report provides a compilation of the number of people from the middle classes in Africa from various sources (table 3).

Table 3

Middle-class population in Africa

Author	Year of analysis	Middle class defined by income	Estimated middle class population
		(Per capita earnings per day)	(Millions)
Bhorat et al., 2023	2015	\$2–\$13 People living on or spending from \$2 to over \$13 per day	29.27–523.31
Kharas, 2010	2009	\$10–100	32
McKinsey and Company, 2010	2008	\$55 and above per household	425
African Development Bank, 2011	2010	\$2–\$20	350
Ravallion, 2009	2005	\$2–\$13	197

Sources: UNCTAD, based on Bhorat et al., 2023; Kharas, 2010; McKinsey and Company, 2010; African Development Bank, 2011; Ravallion, 2009.

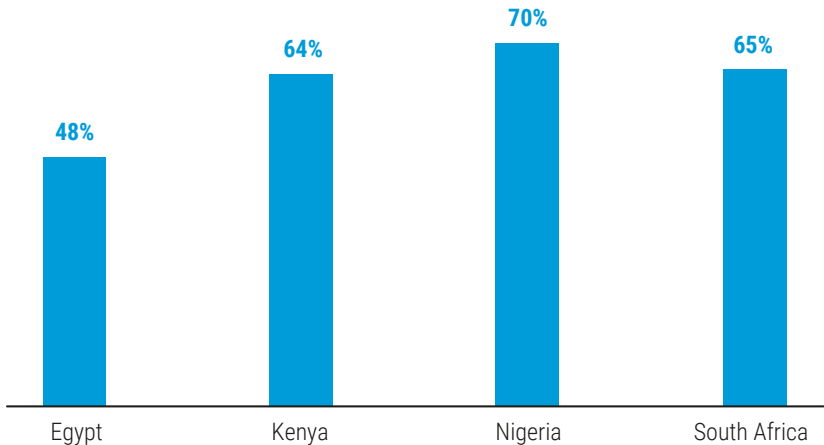
The expansion of the middle class in Africa will be felt through built-up growth impacts on the economy. As more people with higher incomes and purchasing power are lifted out of poverty, consumerism will be stimulated by a growing segment of society, in return fuelling more production for a widening domestic market (Melber, 2022). Further, the concept of a middle class carries with it a sense of financial stability, a developed consumer culture and a clear trajectory of growth (Van Blerk, 2018). Many people of the African middle class buy their goods at local stores and open markets and from street vendors, owing to a lack of formal supermarkets, regimented stock control, brand management (Van Blerk, 2018) and underdeveloped logistic systems.

Although compared with other regions, Africa has been slow to adopt e-commerce, the pandemic has brought a step change in consumer behaviour and e-commerce. Nielsen (2020) reports that a broadening proportion of consumers in Africa will continue to shop online. Additionally, at least 40 per cent of the e-commerce shoppers in each of the four largest economies in Africa plan to reduce the number of trips to physical supermarkets (United Nations, Economic Commission for Africa, 2021) (figure 13).

With the fastest-growing population in the world and the highest concentration of young people, as well as a large potential for e-commerce to their credit, African countries will continue to be magnets for consumer markets and products, with major implications for supply chains in terms of logistics, transportation, warehousing and last-mile distribution. Given the increase in intra-African trading activities, it is expected that African markets

Figure 13

Share of e-commerce users who plan to do less supermarket shopping after COVID-19
(Percentage)



Source: UNCTAD, based on Nielson (2020).

will be reshaped with a greater focus on the creation of new industries and expansion of non-traditional sectors, which will have massive implications for supply chain activities (Oke et al., 2022).

The enlarging consumer market provides room for e-commerce to grow. The fragmented retail and wholesale landscape means that there is no ready-made national—or even regional—network of distributors in most African countries. As mentioned earlier, e-commerce in Africa is at a swiftly developing, yet early stage, with Nigeria, South Africa and Egypt having the most e-commerce traffic. Africa is forecast to surpass half a billion e-commerce users by 2025, which will have shown a steady 17 per cent compound annual growth rate of online consumers in this market. This should indicate a mobile-first approach to any business looking to sell online to the various African markets.

Further, the expansion of the e-commerce market, especially cross-border e-commerce, can transform some areas into regional distribution hubs, as in Mauritius (box 5).

Box 5

Mauritius: A strategic distribution hub for connectivity

Mauritius scored the highest among all the African countries in the DHL global connectedness index 2022 (Altman and Bastian, 2022). With regard to e-commerce, Mauritius not only ranks high in Africa in the 2019 business-to-consumer e-commerce index issued by UNCTAD, but it is also the first African country to sign a free trade agreement with China. (The agreement entered into force on 1 January 2021). As a country that has already ratified the Agreement Establishing the African Continental Free Trade Area, Mauritius could become a gateway to connect China–Africa trade.

Mauritius Freeport serves as the ideal logistics and value addition platform between Africa, Europe and Asia. Set up in 1992 to promote Mauritius as a regional trading and logistics hub, Mauritius Freeport is among the leading hubs worldwide, surpassed only by Dubai Multi Commodities Centre. Moreover, it was named global runner-up and No. 1 in Africa in the Financial Times' fDi's Global Free Zone of the Year 2021 (*fDi Intelligence Magazine*, 2021) (*fDi* [Foreign Direct Investment] *Intelligence*, 2021).

Sources: UNCTAD, based on Altman and Bastian, 2022.

Trade policies and incentives

Despite the well-articulated comparative advantages enjoyed by Africa, without trade, it is unlikely to reap the full benefits of its development. Trade allows countries to specialize in the production of the goods and services that are in alignment with their comparative advantage, while trade policy seeks to foster the establishment of an enabling and favourable environment for countries to do business. Trade policy refers to the tools that a nation may utilize to encourage or discourage imports and exports, including a combination of laws, regulations and agreements.

Preferential trade agreements have become a cornerstone of the international trading system. Owing to the proliferation of these agreements and their enlarged scope, the architecture of the world trading system and the trading environment of developing countries is being swiftly reshaped (Chauffour and Maur, 2011). Preferential trade agreements can generate a complex dynamic gain that operates by changing the rate at which new factors of production, mainly capital, are accumulated (Chauffour and Maur, 2011). Riding on the wave, Africa is engaging in a multitude of such agreements.

The African Growth and Opportunity Act, established by the United States, is a preferential agreement that promotes trade with African countries and the least developed countries. It is a core policy agreement that gives countries in sub-Saharan Africa preferential access to United States markets, allowing them to export products tariff-free. Its aim is to increase trade between the United States and sub-Saharan African countries and more broadly, to foster economic and political development in Africa (see <https://agoa.info/about-agoa.html>). The Act went into force in the year 2000 and was extended to 2025 by the United States Congress (Office of the United States Trade Representative, 2022; Office of the United States Trade Representative, 2023). As at 2023, 35 sub-Saharan African countries were eligible for benefits set up by the agreement.¹²

According to a report by the Economic Commission for Africa (2015), preferential schemes, such as the African Growth and Opportunity Act, can indeed support trade in Africa, including in manufacturing sectors, if stringent rules of origin are relaxed to fit the limited productive capacity of African economies. For Africa to benefit optimally from trade, it must harness regional integration to the fullest and cash in on the advantages of the multilateral trading system (Karingi et al., 2016).

There are positive developments under way in Africa. These include efforts to foster continental and regional integration, such as the recent creation of the African Continental Free Trade Area. Among others, the initiative is aimed at boosting intra-African trade and harmonizing the heterogeneity of trade rules across regional economic communities and under regional trade agreements (UNCTAD, 2021b). Under the Agreement Establishing the African Continental Free Trade Area, countries engaged to remove tariffs on 90 per cent of goods¹³, progressively liberalize trade in services and eliminate other non-tariff barriers.

Beyond the continent, South–South cooperation improved remarkably over a twenty-year period (2003–2023), both in terms of volume and geographic reach (Beshnerati and MacFeeley, 2019). Since 2013, many economies in Africa have become active providers of South–South cooperation. African countries have made significant progress in institutionalizing such cooperation, with the development of national

¹² Angola, Benin, Botswana, Cabo Verde, Central African Republic, Chad, Comoros, Republic of the Congo, Democratic Republic of the Congo, Côte d'Ivoire, Djibouti, Eswatini, Gabon, Gambia, Ghana, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, South Africa, United Republic of Tanzania, Togo, Uganda and Zambia. (see <https://ustr.gov/sites/default/files/files/gsp/2023AGOA.pdf>.)

¹³ Sensitive Products and Excluded Lists for reasons of food security, fiscal revenue, livelihood, and industrialization will comprise 7 per cent of tariff lines and the remaining 3 per cent may be excluded from liberalization.

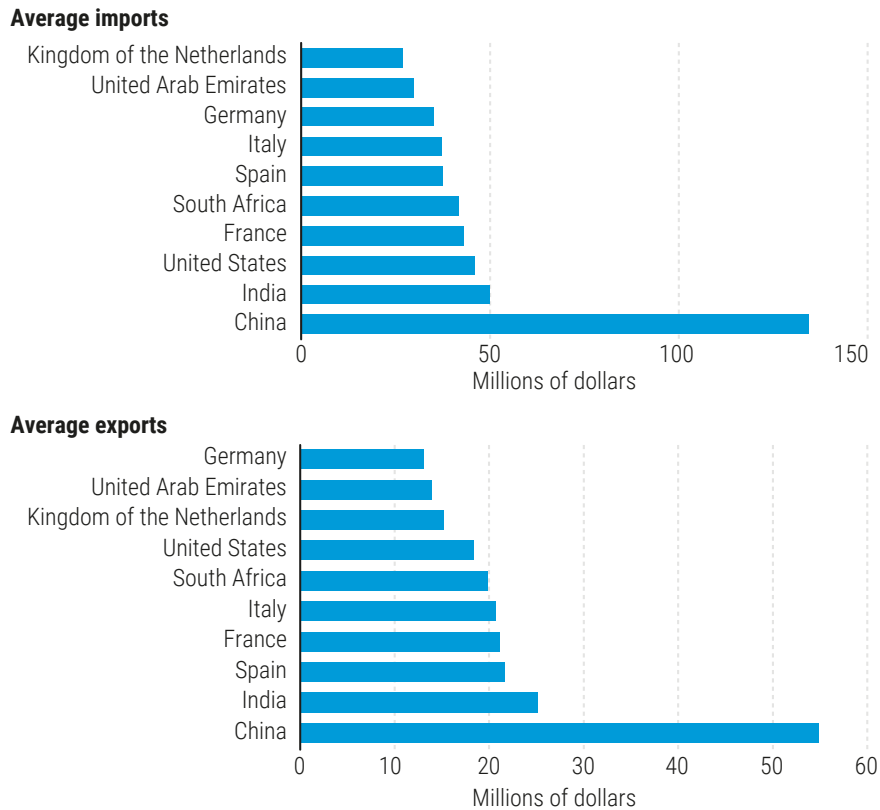
South–South cooperation systems and strategies (United Nations, General Assembly, 2022). The example of South Africa and its partners in the grouping of States called BRICS, that is, Brazil, the Russian Federation, India, China and South Africa, is telling. They are significant trading partners of South Africa. More than 17 per cent of the country's exports were destined for other BRICS countries, while over 29 per cent of total imports came from these countries. In 2014, the BRICS countries launched their own development bank, the New Development Bank, as a novel funding model aimed at fostering South–South partnerships. This initiative benefits Africa, as it helps meet the region's enormous intraregional infrastructure needs and facilitates the regional integration of African countries.



Other similar South–South cooperation initiatives include the Silk Road Economic Belt and 21st Century Maritime Silk Road, which includes among its members more than 94 per cent of the countries in Africa. Such initiatives facilitate access to financing for public and regional infrastructure development projects in Africa, but also contribute to improved vocational training and education opportunities, trade and tourism revenues, transfer of technology or expertise to enter into new sectors, as well as overall living standards (Horigoshi et al., 2022). This South–South trade linkage is vital to the growth of local industry so that African countries can improve intra-African trade and boost global import and export supply chains.

At the bilateral level, patterns of trading between Africa and its key partners can influence supply chain diversification factors, such as technology adoption or transfer, industrial policies and trade policies. Prior to the pandemic and its disruptive effect on global supply chains, China was the chief trading partner of Africa for both imports (\$134 million on average) and exports (\$54 million on average) from 2018 to 2020 (figure 14). India was in second place, after China, with imports from Africa of \$25 million and exports to Africa of \$50 million on average between 2018 and 2020. Of the leading trading

Figure 14
Top trading partners of Africa, 2018–2020



Source: UNCTAD calculations, based on data from the United Nations Comtrade and World Integrated Trade Solution databases.

partners of Africa, China and India are located geographically the farthest. Nevertheless, they represent large economies and big markets, with trade volumes making the trade costs worthwhile. Trade between China and India with African countries is an important illustration of South–South cooperation.

Other major trading partners of Africa are France, Germany, Italy and Spain. Given that the four countries belong to the European Union, this makes the European Union, as a

bloc, a key trading partner. The United States exports more to Africa (\$45 million), than it imports (\$18 million).

Similarly, South Africa, which trades mostly with southern African countries, which are part of the Southern African Development Community trading bloc, imported on average \$41 million worth from African countries, while exporting \$19 million on average between 2018 and 2020. The trading bloc, a regional economic community, has entrenched the removal of both tariff and non-tariff barriers, with extensive freedom of movement of goods and people.

Trade policy can greatly facilitate business activities, but used in isolation will not ensure the advancement of an economy or supply chain integration. Heterogeneous trade agreements among countries in Africa could undermine the efficiency of rules under the African Continental Free Trade Area. Low utilization rates of trade agreements will also hamper the establishment of regional supply chains and stifle commerce (UNCTAD and Common Market for Eastern and Southern Africa, 2023). Therefore, the careful implementation of trade agreements and supportive policies to make sure that trade and economic goals are met (UNCTAD and Common Market for Eastern and Southern Africa, 2023), and dedicated efforts and cooperation among countries and across regional economic and trading blocs, are necessary to reduce the complexity of the regulatory landscape of regional trade, promoting synergies among the various trade arrangements and achieving integration (UNCTAD, 2021b).

Low-income countries in Africa are increasingly utilizing Generalized System of Preference schemes. Their utilization rate rose from 4.9 per cent in 2002 to 63.2 per cent in 2021. By contrast, the utilization of other preference schemes declined from 63.6 per cent in 2002 to about 26.1 per cent in 2021.¹⁴ Often different trade agreements unintentionally cover the same products, therefore the decline in utilization of other preference rates could be a result of a shift to the widening use of the Generalized System of Preference scheme. This is unsurprising, since it is likely better established, with low-income countries in Africa being much more familiar with the Generalized System of Preference scheme than other preference rates based on more recent trade agreements. In addition, low-income countries in Africa continue to benefit from most-favoured-nation-status.

¹⁴ See UNCTAD database on Generalized System of Preferences utilization (<https://gsp.unctad.org>); preference utilization is calculated from all preference-giving countries.

2.3 Opportunities for greening supply chains: Africa as a premium destination

Clearly, production processes can no longer persist on the current path – an alternative production path that will result in lower emissions will need to be adopted. This is evidenced in the signature of 195 countries to the Paris Agreement under the United Nations Framework Convention on Climate Change (United Nations, 2015). The analysis in this chapter so far discusses an alternative production process that would utilize supply sources for a low-carbon future. In addition, the production process offers access to a growing and dynamic labour supply, as well as an advantage in building green infrastructure without the encumbrance of existing legacy infrastructure characterized by high emissions.

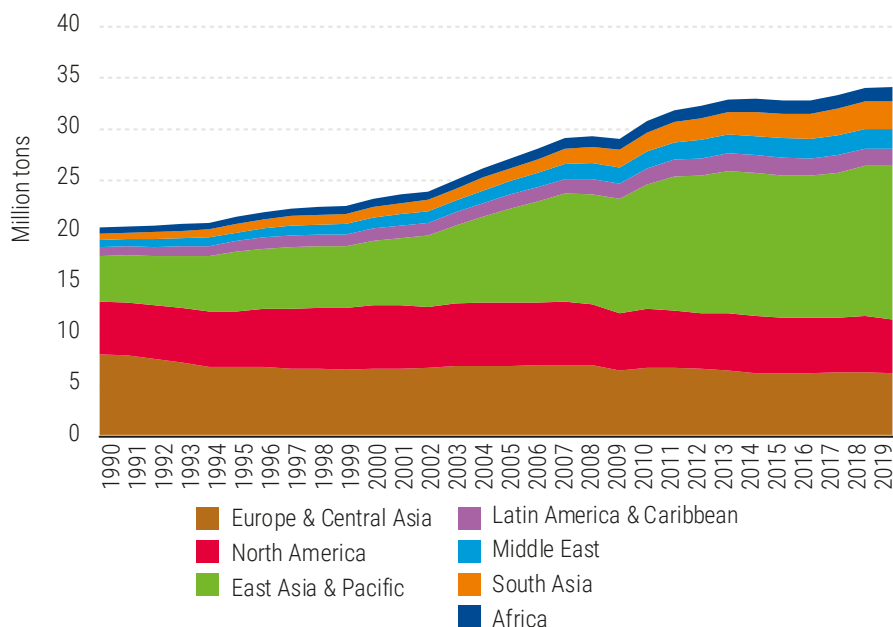
In this section, it is argued that in addition to the comparative advantages Africa offers as an alternative to global supply chain diversification, Africa also enjoys a green advantage; that is, it is a relatively low emitter compared with other regions. Nonetheless, African countries are committed to reducing emissions, with 53 countries not only signatories to the Paris Agreement, but also having ratified it (see <https://treaties.un.org/>).

In addition, African countries have committed to cutting carbon emissions through their nationally determined contributions. Some countries, for example, Angola and Burkina Faso, have committed conditionally and unconditionally to reducing carbon emissions by more than one third of business-as-usual emissions by 2030. The main greenhouse gas emissions in Africa are produced by changes in agriculture, forestry and other land use, which makes up more than 65 per cent of current emissions. Major sources of greenhouse gases are carbon dioxide (CO₂) from burning fossil fuels (coal, oil, and natural gas), land use, forestry and other human-based activities that contribute to CO₂ emissions.

While CO₂ emissions from Africa more than doubled in 2019 (1,403,000 kilotons) compared with emissions in 1990 (615,320 kilotons), emissions were still much lower than in other regions (figure 15). East Asia and the Pacific was not only the region with the largest increase in emissions, but also the one with the highest emissions starting in 2019. Emissions in South-East Asia surged after 2000, an indication of greater production activity coinciding with an increase in outsourcing production processes from the West towards the East. Other regions with high emissions were Europe, Central Asia and North America.

Despite the large and growing population in Africa, CO₂ emission per capita contributions (1.2 kilotons in 2019) remain well below the global level of per capita contributions, which averaged 4.4 kilotons in 2019 (figure 16). African countries have committed to

Figure 15

Global increase in CO₂ emissions, 1990–2019

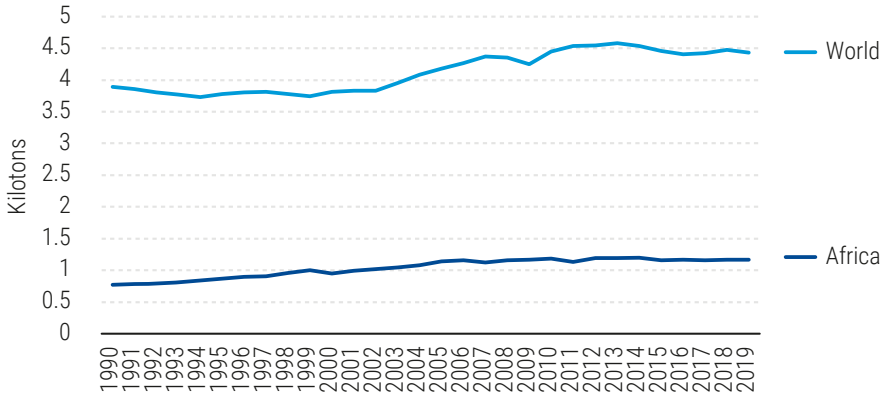
Source: UNCTAD calculations, based on data from the World Development Indicators database (World Bank).

further curb their low greenhouse gas emissions levels, which offers an advantage for companies seeking to diversify their supply chains, with the potential to produce in a sustainable manner, thereby ensuring the fulfilment of Sustainable Development Goal 13 on climate action. For example, with over 60 per cent of its greenhouse gas emissions deriving from electricity production and about 65 per cent of its electricity generated from the production of coal and over 15 per cent from crude oil, the Government of South Africa is taking steps, through its commitments to nationally determined contributions, to recalibrate the energy production mix with a shift towards renewable energy and more energy-efficient lighting.

The green hydrogen potential of Africa also offers opportunities for decarbonizing supply chains, which is becoming a requirement for companies to reduce their greenhouse gas emissions, tackle climate change and in some cases, to operate. A company can

Figure 16

Africa: Average CO2 emissions per capita compared with world average



Source: UNCTAD calculations, based on data from the World Development Indicators database (World Bank).

commit to reducing or achieving net zero carbon emissions through its operations (Greenhouse Gas Protocol Scopes 1 and 2) or through its upstream and downstream activities (Greenhouse Gas Protocol Scope 3).¹⁵ Scopes 1 and 2 are emissions from sources that an organization owns or controls directly (for example, from burning fuel in its fleet of vehicles instead of using electrically powered vehicles) or that are caused indirectly when the energy purchased and used by the company concerned is produced. Scope 3, on the other hand, are emissions that are not generated by the company or the result of activities from assets owned or controlled by it, but by activities or assets for which it is indirectly responsible, up and down its value and supply chains. It is estimated that a company's supply chain produces greenhouse gas emissions (Scope 3) 11.4 times more on average than the emissions of its operations (World Business Council for Sustainable Development, 2021). A company's Scope 3 emissions can be significantly improved by choosing suppliers of lower-carbon materials or relocating its energy-intensive industries, such as steel and chemical industries, to

¹⁵ According to the Greenhouse Gas Protocol, World Resources Institute and World Business Council for Sustainable Development, the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard outlines requirements and offers guidance for companies and other organizations, for example, non-governmental organizations, government agencies and universities, that commit to cutting to net zero levels their corporate-level, operational and linkages greenhouse gas emissions inventory (Scopes 1, 2 and 3). (See <https://ghgprotocol.org/>.)

low-cost countries for renewable and green hydrogen power (Albaladejo et al., 2022; Spiller, 2021). Several African economies hold large potential for green hydrogen production and contribution to decarbonization. For instance, solar energy in Africa has the potential to generate 50 million tons of green hydrogen by 2035 (European Investment Bank, 2022). Moreover, green hydrogen is economically viable, produced at less than \$2 per kg (equivalent to an energy cost of \$60 per barrel) (European Investment Bank, 2022). Its green hydrogen potential makes the continent an attractive destination for supply chain decarbonization in the automotive and pharmaceutical industries.

In focus: Applying inherent and linkage factors to electric vehicle supply chain in Mozambique

Mozambique: A potential supply chain haven

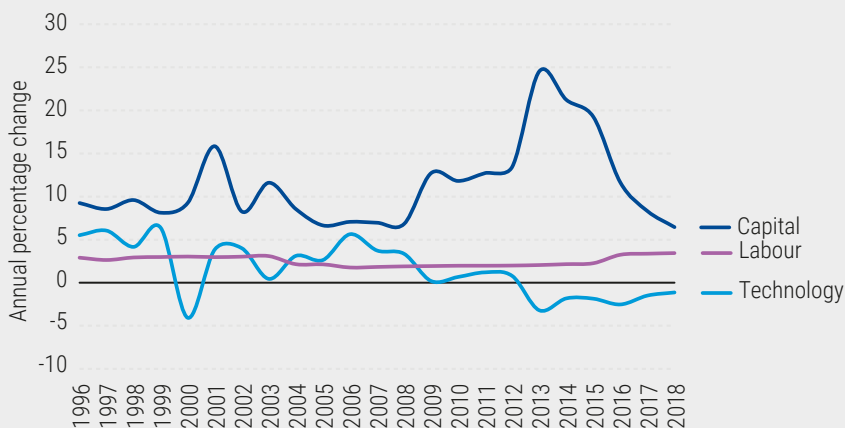
Applying the inherent and linkage factors to the case of Mozambique reveals potential opportunities as a supply chain destination for the electric vehicle industry. The electric vehicle supply chain is discussed in detail in chapter 3. The analysis shows that Mozambique offers many advantages and economic benefits as a potential destination for supply chains of the future – low-carbon transition supply chains. The following section provides an analysis of graphite, a mineral with utility in electric vehicles, and shows that not only can Mozambique supply graphite for global needs for a decade, but also has potential as a haven for the entire supply chain, including the production and distribution of motor vehicles.

Global graphite supplier

As at 2022, Mozambique was one of the world's leading suppliers of graphite, producing 30,000 tons per year. Graphite is used in battery anodes (chapter 3), with demand expected to exceed 2 million tons by 2028. Although graphite is not used in conventional vehicles, about 66.3 kilograms of the mineral are used in electric vehicles (2022 Statista database). It is estimated that Mozambique has 25 million tons in graphite reserves, which at 2028 demand levels, indicates a capability to meet global needs for 12 years as a solo supplier of graphite.

Since 2003, capital has been the main contributing factor to output in Mozambique, peaking in 2013 with the highest contribution to GDP growth, and growing by just under a quarter of the previous year (24.5 annual percentage change). By contrast, the labour growth rate was much lower between 1996 and 2021, averaging 2.5 per cent (figures 17 and 18). The disparity is due to the capital-intensive nature of the extractives sector that makes up most of the industrial sector (aluminium, coal and petroleum products). Nonetheless, about 43 per cent of the country's

Figure 17

Growth of factor inputs in Mozambique

Source: UNCTAD calculations, based on data from the World Development Indicators database (World Bank).

population (just over 32 million in 2021) lies in the 0-to-14 age bracket, an advantage for the future workforce, provided that policies to support labour are implemented properly. Further, policies that promote the development of an electric vehicle or battery manufacturing industry would benefit from labour and capital in the production process, while ensuring value addition in the use of graphite.

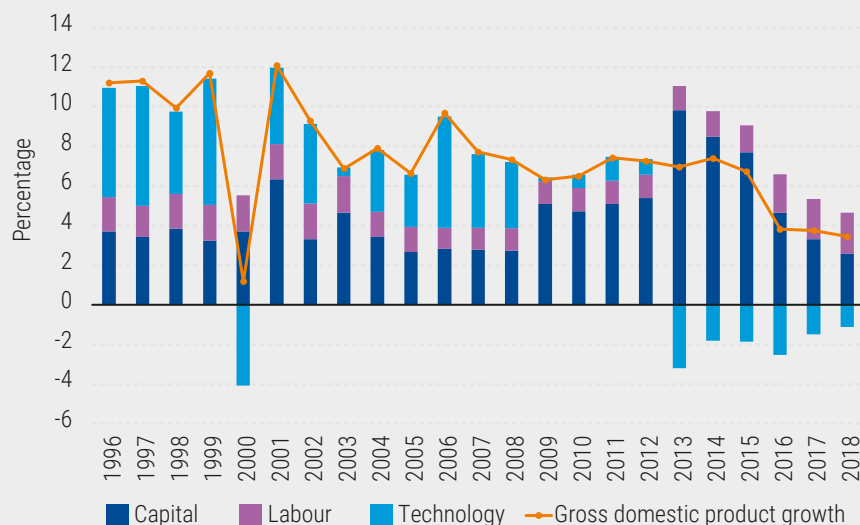
Nonetheless, while capital and labour show a promising trend, technology has been declining in the production process. Indeed, between 2011 and 2020, patent applications for Mozambique numbered 196, an indication of scant technological development. However, the country has made strides in the adoption of services technology, such as in the financial technology area.

Distribution and logistics

Between 2011 and 2015, trade tonnage in Mozambique grew overall by 29 per cent, exports by 36 per cent and imports, by 23 per cent. However, the distribution infrastructure in Mozambique has not kept up with the growth in trade. For instance, according to port performance evaluation criteria, such as account infrastructure quality, port operational effectiveness and logistics

Figure 18

Contribution of factor inputs to growth in Mozambique



Source: UNCTAD calculations, based on data from the World Development Indicators database (World Bank).

efficiency, Mozambique achieved a score of 58, which is less than half that of the benchmark port, Rotterdam, which scored 129, with performance at 59 per cent efficiency of the top-scoring port in sub-Saharan Africa, Durban, South Africa (PricewaterhouseCoopers (2018).

Since 2013, the Government of Mozambique has ramped up spending on infrastructure aimed at increasing the efficiency of inland infrastructure. For instance, with World Bank support, the Nacala corridor, a highway that links the four provinces of Cabo Delgado, Nampula, Niassa and Tete, as well as the neighbouring countries of Malawi and Zambia (both landlocked countries), is set to improve trade logistics efficiency, saving time and costs with regard to the imports and exports of the three countries. They are part of the Southern African Development Community, where there is free movement of labour, capital and goods.

The extensive and accessible coastline of Mozambique makes it an excellent trade gateway to the rest of Africa, as well as to Asia and Europe, a key advantage for possible future industry and supply chain reshoring.

Macroeconomic and environmental policies: Progress in reforms

In 2013, Mozambique came under scrutiny because of the tuna bond scandal, which had adverse impacts on fiscal sustainability. As a result, Mozambique took steps to carry out institutional and fiscal reforms aimed at strengthening governance and engendering fiscal sustainability. However, the COVID-19 crisis and the war in Ukraine affected the country at a time when fiscal space was limited, before the reforms could be fully implemented.

Nonetheless, the country handled the COVID-19 crisis well, with fiscal policies designed to cushion the economic effects of the crisis and commitments to making reforms aimed at regaining macroeconomic stability (International Monetary Fund, 2022b). Mozambique is committed to climate change mitigation and the low-carbon transition and submitted its first nationally determined contributions in December 2021, with specific emissions-reductions targets in the energy and agricultural sectors.

In short, Mozambique is a frontier for the future economy, with all the strengths of a low-carbon transition economy. The country is a key supply source of minerals of the future that are required for use in the electric vehicle and battery industry (see chapter 3). In addition to supply sources, Mozambique has all the necessary strengths to engage in a production process that could provide value addition in a low-carbon transition, with a logistics system that is not encumbered by legacy high-carbon-emissions infrastructure. Mozambique, therefore, is an example of an African country that provides an opportunity for supply chain participating companies to relocate some of their supply chains so as to diversify their supplier relationships and build resilience to shocks.

2.4 Conclusion

It is evident that the disruption of supply chains is going to become the norm, rather than the exception. Shocks such as the COVID-19 pandemic and the war in Ukraine, which have occurred in quick succession, have had far-reaching implications for supply chains. In addition, the adverse effects of climate change, which have sparked questions on how to change production processes to reduce emissions, will have an impact on supply chains, likely shortening them significantly. Consequently, the discourse, especially among the global North, has shifted toward reshoring or diversifying supply chains. The position of Africa as a low emitter of carbon and its ability to adapt easily to low-carbon transition production, makes it an optimal setting for economies and businesses seeking to decarbonize their industries and diversify into green supply chains.