



TRADE AND CLIMATE CHANGE

Information brief n° 5



Climate change adaptation
and Africa: The role of trade in
building agricultural resilience

TABLE OF CONTENTS

KEY POINTS	3
1. AFRICA'S TRADE CHALLENGE	4
2. TRADE FOSTERS RESILIENCE BY LIMITING AFRICA'S VULNERABILITY TO EXTREME WEATHER EVENTS	4
2.1 Connections between climate change, food security and trade	5
2.2 Food security in times of drought and global crisis: evidence from the past	6
I) The introduction of the railroad in India in the nineteenth century	6
II) Drought in Southern Africa in 2015-16	6
III) Price hikes during global crises: the 2007-2008 food crisis and the COVID-19 pandemic	7
3. TRADE AS AN ADJUSTMENT MECHANISM TO CLIMATE-INDUCED REDUCTIONS IN CROP YIELDS	7
4. TRADE POLICIES TO HELP CLIMATE RESILIENCE IN AFRICA	8
5. CONCLUSION	10
REFERENCES	11
ENDNOTES	12

CLIMATE CHANGE ADAPTATION AND AFRICA: THE ROLE OF TRADE IN BUILDING AGRICULTURAL RESILIENCE¹

Information brief n° 5

KEY POINTS

- Trade can play two crucial roles in supporting Africa's efforts to adapt to changing climatic conditions. In the short term, trade cushions the volatility of food markets caused by factors such as climate shocks. Over time, it enables producers and consumers to adapt to changes in comparative advantage, and thereby assists the transformation of Africa's agricultural sector and the diversification of its broader economy.
- The adaptation effect of trade is strongest for hunger-affected and import-dependent regions such as Sub-Saharan Africa, as trade can reduce agricultural prices and increase food availability. International trade can also help create jobs and raise incomes, which strengthen households' resilience, not least by enhancing their ability to purchase food.
- Trade considerations have a role to play in the adaptation components of countries' nationally determined contributions (NDCs), as well as in national adaptation plans. African countries are no exception, and trade could support African climate adaptation policies and strategies.
- Five action areas offer opportunities to help integrate trade and climate adaptation policies in Africa, i.e.: (i) improving the functioning of markets for food and agriculture; (ii) strengthening sanitary and phytosanitary (SPS) measures policies and institutions; (iii) reducing barriers to trade in adaptation goods and services; (iv) enhancing the climate resilience of transport and trade-related infrastructure; and (v) using economic integration policies to promote trade and economic diversification.

1. AFRICA'S TRADE CHALLENGE

Africa's trade in goods and services has been gradually increasing over the last 15 years, yet its share in global trade has remained relatively constant, at about 3 per cent. Even without climate change, the challenge of enabling a growing population to escape poverty is a formidable task for the many countries across the continent, which continues to have close to zero adjusted net savings per capita². Embarking on a sustainable development path remains a huge challenge.

Trade is vital for many African countries with limited domestic markets. However, Africa's geography, characterized by long distances to markets, many landlocked economies, and low population densities across different climate zones, constitutes a powerful barrier to trade. Furthermore, restrictive border measures, including informal ones like road checks, have contributed to high trade costs. Measures to protect the environment are largely absent in the Regional Economic Communities (RECs) along which continental integration is taking place.

Intra-African merchandise exports have grown over the last 15 years, but they still account for only 15 per cent of total African exports. Goods export baskets remain highly concentrated in primary products. Over half of the region's merchandise exports are estimated to be fuel and mining products; about a quarter of them, manufactured goods; and 15 per cent, agricultural products. Limited migration, so far, is another characteristic of Africa's current position in global trade.

Slow- and fast-onset components of climate change are reshaping climatic conditions in Africa. Slow-onset events include a rise in average temperatures (and associated sea level rise) that will be accompanied by increased aridity. Notwithstanding this general trend, local variability implies that some regions may become wetter and cooler. A modification in local climate conditions will shift precipitation patterns, temperatures and the overall seasonality of weather events. Climate change is also expected to alter the natural ranges of pests and diseases, and to disrupt the "predator-prey" relationships that normally keep pest populations in check. In terms of fast-onset events, the occurrence of extreme events, such as heatwaves and torrential rains, is expected to continue, and even increase, as it has in the recent past.³ While slow and fast-onset shocks will have mostly negative impacts on Africa, they can be dampened by trade and by changes in trade policies, the focus of this note.

For Africa, the threat to food security is paramount.⁴ Africa is the region with the largest share of hungry people among the population. About one person in five (21 per cent of the population) was facing hunger in Africa in 2020, more than double the proportion of any other region (FAO, IFAD, UNICEF, WFP and WHO, 2021). Climate change is expected to have implications for both rural and urban populations, and may have differing effects on the food security of different types of actors in rural areas, depending for example on the extent to which the sources of their livelihoods is exposed to the impacts of climate change. Close to 60 per cent of the population of Sub-Saharan Africa lives in rural areas, with many engaged in subsistence agriculture, while close to 10 per cent of the rural population lives in remote less-favoured agricultural land, or on remote land with poor market access (i.e., lacking roads, railways or navigable waterways). These factors complicate any prospective role for trade in agricultural goods to alleviate the threat to food security in these rural areas, unless there is a substantial improvement in trade-related infrastructure.

The role of trade in the adaptation to climate change is further complicated by an additional factor. While Africa is endowed with abundant natural resources (both renewable, like forests, and non-renewable, like subsoil), property rights for these resources tend to be poorly defined, making them vulnerable to "tragedy of the commons" outcomes prone to be exacerbated by international trade. Threats to biodiversity, already present, will increase. Here, under weak environmental governance, increased international trade presents a challenge.

2. TRADE FOSTERS RESILIENCE BY LIMITING AFRICA'S VULNERABILITY TO EXTREME WEATHER EVENTS

This section discusses the channels through which trade can attenuate the effects of fast-onset climate shocks (such as droughts and floods), the frequency and intensity of which are expected to increase over time due to climate change. Past and current examples, which will be further examined hereafter, show how trade helps to cushion the impact of extreme weather events (e.g., the arrival of the railroad in India in the nineteenth century and the 2015-16 Southern African drought) and global crises (e.g., the 2007-2008 food crisis and the COVID-19 pandemic), but also how uncoordinated policies can amplify, rather than mitigate, shocks.

Climate change in Africa is a multi-sectoral threat: to agriculture, tourism, trade infrastructure and coastal communities, especially urban ones. In this brief, we focus on the impacts of climate shocks on the agricultural sector.

The distribution of hazards differs across regions and is expected to continue to do so in the future. Trade across African regions, underpinned by open and transparent trade policies as well as well-performing and climate-proofed ports, roads, railroads and other types of infrastructure, can contribute positively to Africa's efforts to build resilience to climate change.

2.1 Connections between climate change, food security and trade

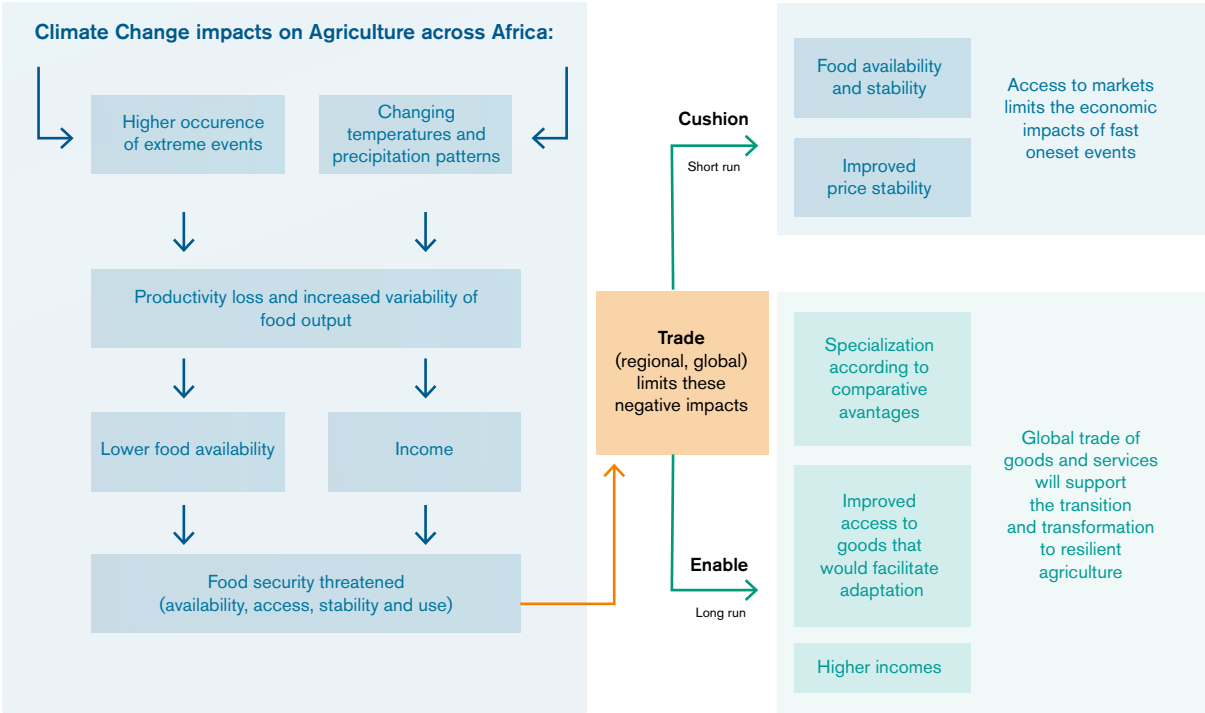
The adaptative capacity of populations in rural Africa, where poverty is greatest, is low. Extreme events disproportionately affect poor populations in arid or semi-arid remote areas.⁵ For example, when a cyclone, flood, or drought hit Mozambique, per capita food consumption dropped by up to 30 per cent – about 0.4 fewer meals per day per person (Baez et al., 2018). In Zambia, the drought that accompanied the 2015-16 El Niño season decreased affected households' maize yields by about 20 per cent and their income by up to 37 per cent (Alfani et al., 2019). More broadly, evidence reviewed in Hallegatte et al. (2016) and Brenton and Chermutai (2021) shows that natural disasters tend to disproportionately affect vulnerable groups of society: the poor and marginalized; women; and micro, small and medium-sized enterprises, many concentrated in rural areas.

Extreme events disproportionately affect poor populations in arid or semi-arid remote areas.

Climate change is likely to impact the four pillars of food security negatively, i.e., food availability (e.g., because of reduced yields on crop and livestock), food access (e.g., because of higher prices), food utilization (e.g., because of impacts on food safety due to an increased prevalence of microorganisms and toxins) and food stability (e.g., because of the increased frequency and severity of weather events) (Mbow et al., 2019).

Figure 1 illustrates the channels through which climate change affects food security, and how trade contributes to adaptation. Specifically, trade can play two crucial roles in supporting Africa's food systems in the context of a changing climate. In the short run, trade cushions the volatility of food markets by providing a vital flow of supplies to regions that may see a sudden reduction in domestic production of food crops due to a climate shock. In the long run, the effects of a changing climate, along with ongoing urbanization, call for changes in crop and livestock cultivation. Trade enables changes in comparative advantage, thereby helping the transformation of Africa's agricultural sector and broader economic diversification.

Figure 1 Trade as a cushion and enabler in developing agricultural resilience to climate change



Source: Authors.

International trade can also help to create jobs and raise incomes, which strengthens resilience.

More broadly, international trade can also help to create jobs and raise incomes, which strengthens resilience, not least by enhancing poor people’s ability to purchase food. As many African countries are expected to become more heavily food-import-dependent, increasing trade in other sectors (including services and manufacturing) could help to finance these food imports.

2.2 Food security in times of drought and global crisis: evidence from the past

In order to support food security, trade must be underpinned by open, transparent and predictable policies that improve how food markets function, not least by allocating resources more equitably and sustainably. The role of trade policy in examples of shocks to the food system is further discussed below.

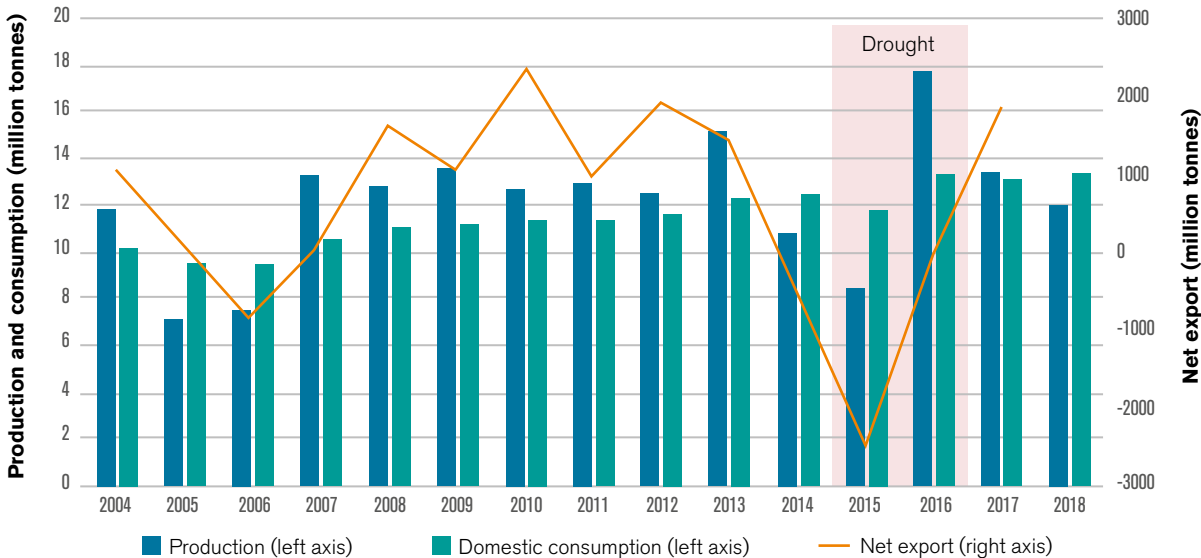
I) The introduction of the railroad in India in the nineteenth century

A landmark historical example of the power of trade to alleviate food insecurity is the arrival of the railroad in India in the nineteenth century and how this altered the relationship between climate effects and excess mortality. This example also underscores the importance of hard infrastructure (ports, railroads and roads) to enable trade to cushion the effects of disasters. Specifically, a study by Burgess and Donaldson (2010) shows that productivity shocks in the form of rainfall shortages – estimated to have caused between 15 and 30 million deaths during the period 1875-1919 – almost entirely disappeared with the arrival of the railroad in India. The arrival of the railroad also significantly reduced the exposure of agricultural prices and real incomes to rainfall shocks (Donaldson, 2018).

II) Drought in Southern Africa in 2015-16

Droughts in Africa affect more people – especially the poor – than any other natural hazard. With 43 per cent of its area classified as arid, Southern Africa was particularly hard-hit by the 2015–16 El Niño-induced drought. At least 11 million people required urgent assistance as the decline in food production brought food insecurity, malnourishment and stunting that affected 30 per cent of the children in the region. Deficits in staple crops like maize (which make up 30 per cent of caloric intake) forced poor rural households to purchase imported maize (see Figure 2), the price of which increased sharply because of the drought-induced currency depreciation. Nonetheless, sufficiently developed infrastructure enabled trade to cushion the drought shock. Import restrictions on maize were lifted, improving food availability on the domestic markets and attenuating price hikes. The region switched from being a net food exporter to being a net food importer.

Figure 2: Southern Africa’s maize imports rose as domestic output fell during the 2015-16 drought



Source: Hepburn et al. (2021).
 Note: Southern Africa includes Botswana, Eswatini, Lesotho, Namibia, and South Africa.

The drought also sharply affected livestock, which is estimated to account for 35 per cent of African agriculture. Government support relief packages included support for livestock feed and support for crop production inputs, such as seeds, fertilizers and farming implements. For example, in Botswana, the government doubled its subsidies for livestock feed to 50 per cent and the export of live cattle was allowed to avoid cattle mortality. This put further pressure on struggling farmers in South Africa.

These events show that easing restrictions on food imports is an important policy response that governments can use to help consumers respond to sudden shortages, by improving the availability of food on domestic markets and helping to attenuate sudden price spikes. Governments also need the flexibility to be temporarily increase support to producers when a shock occurs. In the longer run, governments need be able to support the provision of national and regional public goods and services, such as research into more resilient plant varieties to help boost yields sustainably, and early warning systems to better inform farmers about extreme weather events or disasters such as locust invasions.

III) Price hikes during global crises: the 2007-2008 food crisis and the COVID-19 pandemic

The last example showed how policy reactions to large shocks generate strong spillovers that require collective action to be controlled. This was also the case with the food price crisis of 2007-08 and the COVID-19 pandemic.

During the 2007-08 food crisis (during which food prices increasing dramatically for a variety of reasons), the major exporters of rice and wheat restricted exports; and export restrictions were enforced on medical equipment during the early phases of the COVID-19 crisis, and on vaccines more recently. Both of these episodes harmed African countries, and illustrate the need for collective action to dampen global shocks. For example, the insulating behaviour adopted by major exporters is estimated to have been responsible for 45 per cent of the price increase of rice and 30 per cent of the price increase of wheat contributing to the price hikes during 2006–08 (Martin and Anderson, 2014).⁶

Compared with the 2007-08 food crisis, export restrictions during the COVID-19 pandemic were short-lived and less pervasive. The affected goods only accounted for 5 per cent of the world market of calories, down from 18 per cent during the 2008 global food crisis. Critically, restrictions were short-lived, as most of them had been lifted or had expired by the end of April 2020. Major exporters of rice in the Association of Southeast Asian Nations (ASEAN) quickly removed restrictions on rice exports. These measures helped to prevent the pandemic from triggering a more far-reaching food crisis. Simulations show that an export ban on rice and wheat during 2020 (accompanied by a reduction in import tariffs of 25 percentage points in importing countries) would have raised the average world price of these cereals by over 10 per cent, putting 5 million more people at risk of hunger in Sub-Saharan Africa.⁷

The COVID-19 crisis also illustrates the importance of cooperation. Faced with plummeting availability of essential goods (medical supplies, but also food) in international markets, some countries tried to secure these goods by reducing import barriers while simultaneously restricting exports (Baldwin and Evenett, 2020). Global level estimates by Espitia et al. (2020) for food suggest that uncooperative trade policies could have multiplied the initial COVID-19 shock on trade by a factor of three, with food-dependent low-income countries in Africa hit hardest. Fortunately, many import-restrictive measures in the agricultural sector were short-lived (WTO, 2020).

3. TRADE AS AN ADJUSTMENT MECHANISM TO CLIMATE-INDUCED REDUCTIONS IN CROP YIELDS

The onset of climate change is projected to harm agricultural production in various ways, including by reducing the yields of crops such as maize, rice and wheat. Sub-Saharan Africa is expected to be the world's most severely affected region, with average crop yields estimated to decrease by 40 per cent by 2080 (Gouel and Laborde, 2021).

Using spatial data on climate-induced reductions in crop yields, a number of recent studies have analysed the related economic and social impacts, pointing to the importance of trade as an adaptation mechanism to climate change, alongside adjustments in production and urbanization.

As climate change is affecting crop yields within and across countries in different ways, this changes comparative advantage patterns in the production of crops. Related adjustments in production and trade can contribute to reducing welfare losses from climate change. Costinot et al. (2016) show that production adjustments in line with changed comparative advantage can substantially mitigate the negative effects of climate change.

Sub-Saharan Africa is expected to be the world's most severely affected region, with average crop yields estimated to decrease by 40 per cent by 2080.

Gouel and Laborde (2021) estimate that climate-induced changes in crop yields as estimated for 2080 could reduce welfare globally by 1 per cent. Adjustments in trade patterns and the choice of crop production would contribute to reducing global welfare losses by 23 per cent and 37 per cent, respectively. In the case of trade, the ability to adjust import sources plays an important role in adapting to climate change. However, Gouel and Laborde also find that the impact of climate change differs substantially across countries. Net food-importing tropical countries are severely harmed by negative productivity shocks and increased global food prices, while countries exporting agricultural products tend to gain thanks to improved terms of trade. It is estimated that Sub-Saharan Africa will experience an average welfare loss of around 6.5 per cent, the largest among all regions, due to large decreases in potential yields on some key African crops such as cocoa and tropical roots, its dependence on food imports, as well as the high importance of agriculture for its economies.

Studies have also pointed to the important role played by trade in preventing hunger. Janssens et al. (2020) estimate that, under the current level of trade integration, climate change could increase the global number of people who suffer from hunger to 55 million by 2050. However, the phasing-out of agricultural tariffs and the introduction of other trade-facilitating measures could reduce the impact of climate change on undernourishment by 64 per cent, which would correspond to around 35 million people not suffering from hunger because of climate change. The adaptation effect of trade would be strongest for hunger-affected and import-dependent regions such as Sub-Saharan Africa, as trade reduces agricultural prices and increases food availability. Hertel and Baldos (2016) estimate that increases in global crop prices could raise malnutrition among households not employed in the farming sector by around 45 per cent globally in a less integrated world economy, compared with a rise of less than 30 per cent in a more integrated world where the most affected regions are able to import food from regions where climate change impacts are relatively less severe.

The phasing-out of agricultural tariffs and the introduction of other trade-facilitating measures could reduce the impact of climate change on undernourishment by 64 per cent.

Besides production and trade, labour mobility within and across countries is a third adjustment mechanism to climate change. Conte (2021) estimates that climate-induced changes in crop yields could displace 12 per cent of the population in Sub-Saharan Africa and reduce its real GDP by 4 per cent. Lower trade frictions would strengthen agglomeration effects and lead to greater sectoral specialization between locations, reducing economic losses from climate change and fostering structural transformation in Africa through increased urbanization.

4. TRADE POLICIES TO HELP CLIMATE RESILIENCE IN AFRICA

International trade in goods and services can help lower the cost of climate adaptation in the short term and promote economic and export diversification in the long term. In addition to helping countries adapt to the impacts of extreme climate events and changing climate conditions, trade also strengthens countries' resilience to climate change by fostering economic growth and reducing poverty (IMF, World Bank and WTO, 2017). Yet, trade considerations have been largely absent from the adaptation components contained in countries' nationally determined contributions (NDCs) under the 2015 Paris Agreement (i.e., each country's pledged efforts under the Agreement to reduce emissions and adapt to climate change), let alone the national adaptation plans (i.e., identifying adaptation needs and developing and implementing strategies to address those needs) produced to date.

Africa is no exception in pursuing largely disjointed trade and climate adaptation policies and strategies. One glaring example of this is the absence of any reference to climate change or the environment in the African Continental Free Trade Area (AfCFTA) agreement established in March 2018 and effective from 1 January 2021. As a result, many African countries may be foregoing significant opportunities to bolster their climate adaptation strategies through proactive, forward-looking trade policies. In some cases, the pursuit of trade policies that are not aligned with the urgent need to adapt to a changing climate may even be undermining African countries' climate adaptation efforts.

The following five action areas offer opportunities to help integrate trade and climate adaptation policies in Africa and to ensure that international trade can support the continent's climate adaptation and economic diversification strategies. Integrating trade and climate adaptation policies requires action by African countries, both at national and regional levels, along with action by all WTO members.

Integrating trade and climate adaptation policies requires action by African countries, both at national and regional levels, along with action by all WTO members.

- **Improve the functioning of markets for food and agriculture:** In an interconnected global economy in which global value chains span national boundaries, policy actions in one country, including in response to climate shocks, can affect producers and consumers in other countries. Governments should therefore ensure that the policies they adopt in response to climate shocks, while still achieving better climate and development outcomes, do not undermine the competitiveness and resilience of food producers and consumers in other jurisdictions. For example, governments that subsidize their farm sectors can seek to repurpose support in ways that improve the delivery of public goods, and which minimize impacts on trade and markets. Major trading economies can usefully reform restrictions on food exports and imports in such a way that they address objectives connected to food security and farm livelihoods both at home and abroad – for example, by ensuring that policies foster fair competition, help to boost productivity and raise rural incomes, and contribute to climate mitigation and adaptation. Many types of policies that boost productivity sustainably are allowed without limits under WTO rules, such as those concerning farmer extension and advisory services, research, rural infrastructure, and pest and disease control. Governments could use these programmes to redress historic underinvestment in the farm sector and improve resilience to future shocks.
- **Strengthen policies and institutions for sanitary and phytosanitary (SPS) measures:** As intra- and extra-regional trade in agricultural commodities is likely to increase with climate change, regulatory bodies that set SPS measures will have to be strengthened to deliver safe trade at least cost. This will be particularly critical in the face of new challenges brought about by climate change. Increasing temperatures, changing rainfall patterns and more frequent extreme weather events are expected to change the natural ranges of pests and diseases and disrupt the “predator-prey” relationships that normally keep pest populations in check. Sound SPS policies and institutions are a prerequisite for safe and efficient trade. Countries that are unable to provide traceability in the value chain and that cannot build the necessary trading infrastructure, for example, by providing certification and inspection services to ensure that their products meet SPS and other requirements, may be excluded from markets overseas. The same challenges apply to trade in agricultural products within Africa. The Standards and Trade Development Facility (STDF) is a global partnership of the WTO, the Food and Agriculture Organization of the United Nations (FAO), the World Organisation for Animal Health (OIE), the World Bank Group and the World Health Organization (WHO) that is helping African countries to meet some of these challenges.
- **Reduce barriers to trade on goods, services and technologies for adaptation:** Open and transparent trade policies are an integral part of a broader strategy to access high-quality, low-cost goods and services that are essential to help the agricultural and other economic sectors to adapt to climate change. Examples of such goods and services include stress-tolerant cultivars, pesticides for weed control, early warning systems, equipment for renewable off-grid power generation, irrigation technology and related engineering and technical services, as well as agricultural extension services. Additional policy efforts – by African countries individually and by WTO members collectively – to reduce remaining tariffs and other trade barriers and facilitate trade could further enhance supply chains for climate adaptation goods and services, reduce costs, and accelerate the dissemination and deployment of climate adaptation technologies around the world.

For Africa specifically, eliminating barriers to trade in climate adaptation goods and services would significantly reduce the cost of acquiring the efficient, innovative and competitive inputs that are critical to carry out countries' adaptation priorities (Garsous and Worack, 2021). One example is import tariffs. In the case of lower-income and lower middle-income African countries, import tariffs on an illustrative list of 56 goods relevant to adaptation averaged close to 10 per cent.⁸ For specific goods, tariffs can be as high as 50 per cent in some African countries. A group of WTO members is considering ways to advance work on liberalizing trade in environmental goods and services based on past efforts in this area, including the negotiations towards an Environmental Goods Agreement, which were suspended in 2016.

- **Enhance the climate resilience of transport and other key trade-related infrastructure:** Climate change is projected to take a particularly heavy toll on road systems. To cope with heat and humidity extremes, Africa will require substantial investment in transport, as well as in energy and communications infrastructures, over the next decades. To ensure that spending on trade-related infrastructure delivers the best possible return and brings lasting development benefits, it is critical that investment plans consider the consequences of a changing climate. This calls for better understanding of risks and vulnerabilities, availability of more tailored data and information, and the development of guidance, standards, best practices, methodologies and other tools in support of climate-proof infrastructure investment.

The WTO-led Aid for Trade initiative, launched in 2005, can help to mobilize investment in climate-resilient infrastructure. Aid for Trade aims to help developing countries, particularly least-developed countries, to build the supply-side capacity and trade-related infrastructure that they need to implement and benefit from WTO agreements,

and more broadly to expand their trade. Since its launch in 2005, the Aid for Trade initiative has helped to mobilize investments for building climate-resilient infrastructure, e.g., US\$ 25 billion was invested in 2019 to build energy, transport and telecommunications infrastructure, representing 55 per cent of overall Aid for Trade disbursements, according to the Organisation for Economic Co-Operation and Development – Development Assistance Committee (OECD-DAC) Credit Reporting System (CRS) Aid Activities Database.

- **Use economic integration policies to promote trade and economic diversification to reduce reliance on sectors that are highly exposed and vulnerable to climate change:** The proliferation of regional and global value chains has important implications for African countries and their ability to diversify their economies. Value chains provide an opportunity for African countries to integrate into global and regional markets by exporting just one part or component of a product, instead of having to develop the industrial base required to manufacture the entire finished product from scratch.

Africa's participation in regional and global value chains is determined by factor endowments, geography, market size and institutions. But these fundamentals alone need not determine patterns of specialization across countries. To remedy the scarcity of capital, technology and management skills needed to develop new economic activities, African countries need to improve policies in order to attract foreign direct investment.

To free domestic enterprises from the limits of domestic demand and local inputs, and to improve their access to new and expanding regional and global markets, governments should adopt trade-facilitating and trade-opening policies at home, and negotiate better market access conditions abroad. Improving connectivity through transportation and communications infrastructure and introducing competition into these services could help African countries to overcome remoteness or the disadvantages of being landlocked. Implementation of the AfCFTA offers opportunities to further develop regional value chains, including in more climate-resilient agricultural and manufacturing sectors. And participating in deep integration agreements can be a catalyst for institutional reform, especially when complemented by technical and financial assistance.⁹

Improving connectivity through transportation and communications infrastructure and introducing competition into these services could help African countries to overcome remoteness.

The Aid for Trade initiative focuses on economic diversification as being key to development, and can therefore play a supportive role in helping African countries to create an enabling environment to diversify their economies. In the context of the Aid for Trade monitoring exercise conducted in 2019, 97 per cent of African respondents pointed to economic diversification as a priority (OECD and WTO, 2019). African countries also recorded the highest share of responses saying they had seen progress in economic diversification since the launch of the Aid for Trade initiative.

5. CONCLUSION

African countries and their agricultural sectors are among those most at risk from the impacts of climate change. International trade in goods and services can help to lower the cost of climate adaptation in the short term and to promote economic and export diversification to reduce their reliance on vulnerable sectors in the long term.

To fully capture the potential benefits of international trade for climate adaptation, governments need to work with individuals, micro, small and medium-sized enterprises, corporations, financial actors and civil society in order to put in place trade policies that are fully aligned with, and supportive of, climate adaptation strategies and policies. Five action areas offer opportunities to do this: (i) improving the functioning of markets for food and agriculture; (ii) strengthening policies and institutions for SPS measures; (iii) reducing barriers to trade in adaptation goods and services; (iv) enhancing the climate resilience of transport and other key trade-related infrastructure; and (v) using economic integration policies to promote economic diversification. Each area of opportunity can and should be tailored to the specific circumstances of African countries and to specific forms of participation in the regional and global economies.

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ENDNOTES

- 1 This note closely reproduces material from a chapter on Trade contributed by the WTO Secretariat to the Global Center on Adaptation (2021), *State and Trends in Adaptation Report 2021: How Adaptation Can Make Africa Safer, Greener and More Prosperous in a Warming World*. This document has been prepared under the WTO Secretariat's own responsibility and is without prejudice to the positions of WTO members or to their rights and obligations under the WTO.
- 2 Adjusted net savings (or investment) represent increases in physical capital adjusted for changes in human capital and the stock of natural assets, which include geology, soil, water and all living things. See estimates in Lange et al. (2018).
- 3 See IPCC (2021).
- 4 The 1996 Rome Declaration on World Food Security defines food security as follows: "Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life." (Food and Agriculture Organization of the United Nations [FAO], 1996) The provision of food security can be seen as an integral part of the realization of the right to food.
- 5 Barbier (2020) shows that the most remote population in Africa lives off the least productive lands and is also the poorest, with little access to health and education.
- 6 Martin and Anderson (2014) note that this collective action problem is akin to a situation when a crowd stands up in a stadium to get a better view. No one gets a better view by standing, but any that remain seated get a worse view. In the case of restrictions on food exports, as net importers, African countries have small shares, so reductions on import tariffs would help them individually, but have small effects on world prices.
- 7 The simulations are from the International Food Policy Research Institute (IFPRI) International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) model, which links information from climate models (earth systems and water models) to multi-market partial equilibrium models of the agricultural sector to simulate changes in biophysical systems, socioeconomic trends, technologies and trade policies. See Robinson et al. (2015) for the model description and Sulser and Dunston (2020) for discussion of the results cited here.
- 8 Defining a list of "adaptation-relevant" goods is complex, as most goods helpful for climate adaptation efforts have other usages as well.
- 9 Controlling for many confounding factors, Abman, Lundberg and Ruta (2021) show that the inclusion of deforestation provisions in trade agreements reduced forest loss by 7,571 km² from 1960 to 2020, the effects being most pronounced in ecologically sensitive areas.



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