Climate

Implications of a Global Carbon Tax

Alize le Roux and Jakkie Cilliers

Last updated 11 April 2024 using IFs v8.17

Table of contents

Implications of a Global Carbon Tax

Briefly

Globally, nations are actively adopting diverse carbon strategies to curb emissions and promote environmental responsibility. These strategies include investments in renewable energy (to speed up the energy transition), the setting of ambitious emission reduction targets (as outlined in the various country NDCs) and the implementation of carbon pricing mechanisms such as carbon taxes and emission trading systems (e.g. cap-and-trade systems).

Views and progress

Carbon taxes are relatively straightforward and predictable mechanisms to assign a fixed cost to carbon emissions, incentivising businesses and individuals to adopt cleaner technologies and sustainable practices. The revenue generated from these taxes can then be channelled into initiatives such as renewable energy projects (to speed up the energy transition) or climate change adaptation (to safeguard communities and infrastructure). These powerful incentives have proven very effective in reducing carbon emissions. Still, despite the importance of carbon pricing, only a few countries have implemented a carbon tax as concerns persist about its impact on vulnerable populations and potential cost transfers to consumers. In 2021, around 6% of emissions were in countries or sectors with a carbon tax and 20% were covered by a trading system. This means that, in total, a carbon price was paid on only 26% of global emissions.

As of March 2023, only Japan (amongst the top 10 global emitters) had adopted a carbon tax, with Indonesia announcing its intention to work towards implementing a carbon pricing initiative. European countries are amongst the forerunners in adopting carbon taxes, with countries like Finland, Sweden, Norway, Denmark, and Poland already introducing a carbon tax in the early 1990s. According to the World Bank's Carbon pricing dashboard, carbon tax in Europe ranges from US$0.82 per metric ton in Ukraine to as much as US$ 130 in Switzerland. Global South countries like South Africa, Uruguay, Argentina and Chile have also implemented a carbon tax, with Uruguay having the highest carbon tax rate worldwide at US$156 per metric ton of CO_2. Globally, 37 carbon tax initiatives have been implemented (at a National or Subnational level), with several additional countries (e.g. Botswana, Indonesia, Morocco and Senegal) announcing their intention to work towards implementing a carbon pricing initiative. These initiatives, however, cover only 2.76 gigatons, representing a mere 5.62% of global GHG emissions.

Major emitters like the USA, Russia, India, Iran and Saudi Arabia have remained cautious, either considering Emission Trading Systems (ETS) or shying away from carbon pricing. Subnational ETS are present in a handful of US states (e.g. California, Oregon, Washington and Massachusetts), while China adopted the world's most extensive ETS in 2021. There are 36 ETS pricing initiatives globally, representing 17.64% of global GHG emissions. The oldest ETS is the EU Emissions Trading System, a Cap-and-Trade system established in 2005.

ETS effectively sets an overall cap on emissions, allocates emission allowances to covered entities, and allows trading of these allowances, thereby creating market incentives for industries to lower their carbon emissions. This enhances flexibility and efficiency in reducing overall greenhouse gas emissions. While ETS have proven effective, they have been shown to cause 'carbon leakages', where industries may move to regions with less stringent environmental regulations, resulting in a shift in emissions rather than a genuine reduction. This can compromise the effectiveness of carbon reduction efforts and lead to unintended environmental consequences.

A 2023 study on the ETS pilot areas in China showed outsourcing of carbon emissions in pilot areas to non-pilot areas where less stringent environmental laws persist. This phenomenon was also observed in the EU ETS, prompting the proposal of a Carbon Border Adjustment Mechanism (CBAM) to ensure that imported goods face a comparable carbon cost to domestically produced goods, preventing a competitive disadvantage for EU businesses and incentivising global partners to adopt emission reduction measures. The EU CBAM (legislated as part of the EU's Green Deal) aims to align industries within and outside the EU and will impact specific carbon-intensive goods from 2026 onward. Concerns have been expressed about the potential harm to several African economies, specifically the risk to industries in low- and middle-income countries (LMICs), as they may lack the resources to decarbonise production.

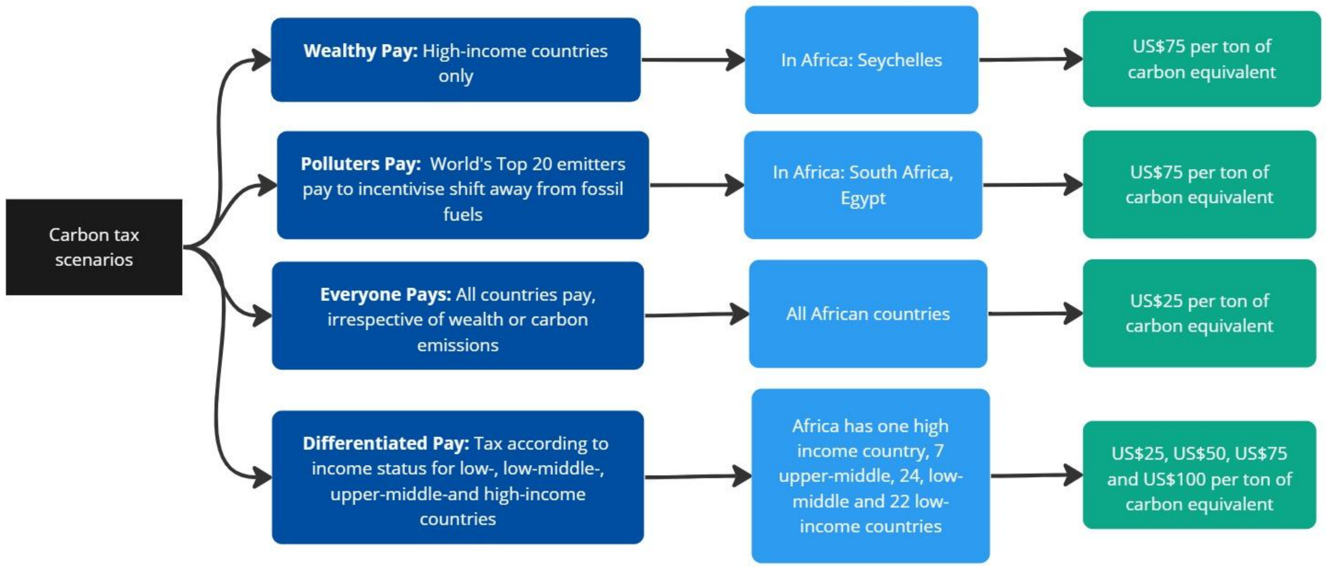
What is clear from the above is that there are numerous different and fragmented approaches to carbon pricing worldwide and that many countries responsible for contributing to high GHG emissions are not directly paying taxes on these emissions. There is growing support (backed by institutions such as the World Bank and the IMF) for a uniform (global) carbon tax framework to drive emission reductions worldwide. An international framework would be more transparent and improve emission reduction efficiency and effectiveness. A single carbon tax framework will also be less complex. Still, it must be flexible enough to consider countries' economic structures, incorporate precise compensation mechanisms to address potential disparities and diverse national circumstances and include technical and financial assistance provisions for developing countries.

Under the Paris Agreement, the principle of common but differentiated responsibilities (CBDR) was established. This principle, aligned with the Just Energy Transition initiative, advocates for a collective global responsibility in addressing climate change. It recognises that all governments are responsible for tackling environmental destruction worldwide, but not equally. This acknowledgement stems from the understanding that earlier industrialised economies have historically contributed more to the climate crisis. In this context, advocating for richer countries to pay more significant taxes reflects a commitment to addressing historical disparities and ensuring a fair distribution of the financial responsibility for mitigating climate change. The International Carbon Price Floor (an IMF proposal) advocates for a minimum carbon price ranging from US$25 to US$75 per metric ton of CO_2, depending on the country's development level.

Four carbon tax scenarios

Following this analysis, we explore four carbon tax scenarios, summarised in Chart 11.

Chart 11: Global Carbon Tax scenarios



In the **Wealthy Pay scenario,** we argue that present-day developed countries obtained their wealth through an enormous environmental impact and should be taxed accordingly. A high-income country carbon tax is introduced at US$75 per metric ton of carbon equivalent, phased in over ten years from 2026. Since China (the world's largest carbon emitter) is on the cusp of graduating to high-income status ranks an equal carbon tax of US$75 is introduced but phased in over a longer time horizon (15 years) to allow for a smoother transition. It would currently only affect Seychelles in Africa, but due to its low carbon emission (2nd smallest carbon emissions in Africa), the impact would be minimal.

In the **Polluters Pay scenario**, countries that release more than 80 million tons of carbon (or 294 million tons of CO_2) per annum in 2023 pay a carbon tax of US$75 per metric ton of carbon equivalent, which is phased in over ten years from 2026. Therefore, this intervention places a carbon tax on countries collectively responsible for 80% of the world's emissions, affecting the world's top 20 emitters. Half of these countries are classified as high-income countries, with eight upper-middle-income countries and two lower-middle-income countries. They host 60% of the world's population and generate 76% of the world's GDP.

In the **Everyone Pays scenario**, the responsibility for reducing carbon emissions is shared across all nations, reflecting the collective responsibility of combating climate change. All countries eventually pay US$25 per ton of carbon equivalent emissions (in line with the Carbon Price Floor), including all African countries. The tax is phased in over ten years starting in 2026. However, a recent study by the WTO stresses that Low-income countries would adversely be affected by such a Carbon Price Floor and that even a low-carbon price would impact production decisions and reduce real income in these countries.

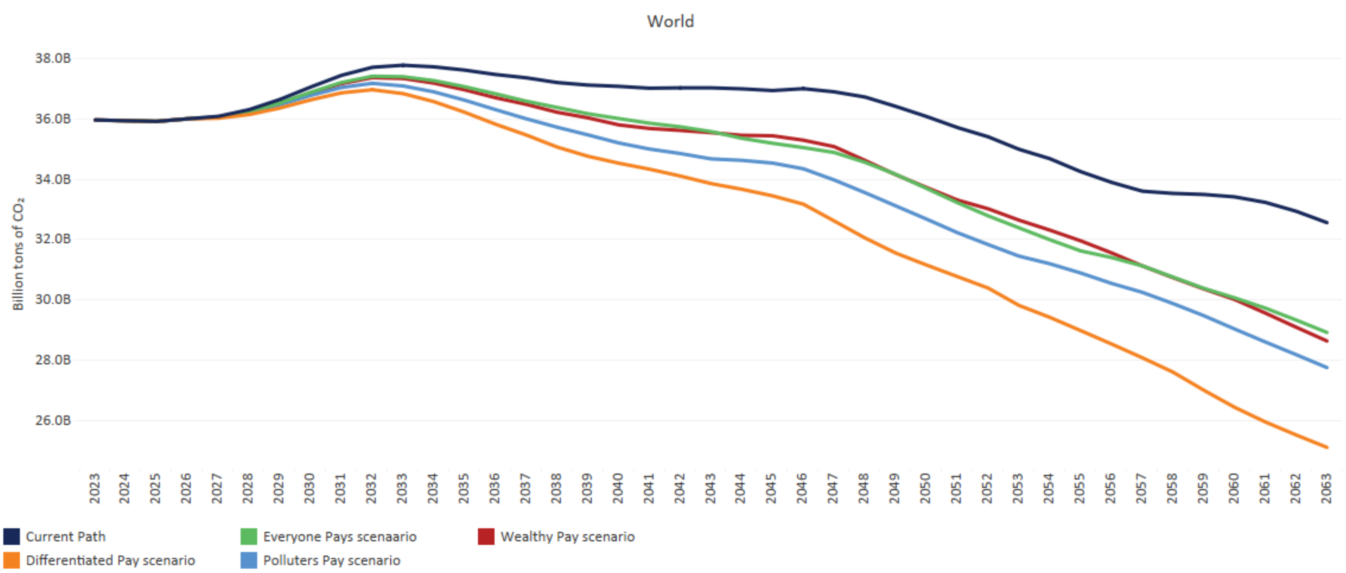
In the **Differentiated Pay scenario,** a country's income classification determines the economic costs of implementing carbon taxes. In this scenario, high-income countries pay US$100 per ton of carbon equivalent while upper-middle-income countries pay US$75/ton, which is phased in over ten years starting in 2026. Lower-middle countries pay US$50/ton, and low-income countries pay US$25/ton, which is phased in over 15 years and will start in 2026. In 2024, Africa had one high-income country, seven upper-middle-income countries, 24 low-middle-income countries and 22 low-income countries.

Compared to the Current Path scenario, all carbon price interventions make a substantial difference in carbon emission reduction from fossil fuels (Chart 12), reducing the accumulated CO2 in the atmosphere (Chart 13) albeit to levels still on par with an RCP4.5 world.

The Differentiated Pay scenario has the most significant effect on carbon emission reductions (15% below the 2050 Current Path forecast and 25% lower in 2063); this is followed by the Polluters Pay scenario (10% below the Current Path forecast in 2050 and 16% below the Current Path in 2063). The impact of the Everyone Pays and Wealthy Pays scenarios are very similar, with both dropping carbon emissions by 7.5% compared to the Current Path forecast in 2050 and 13% less by 2063.

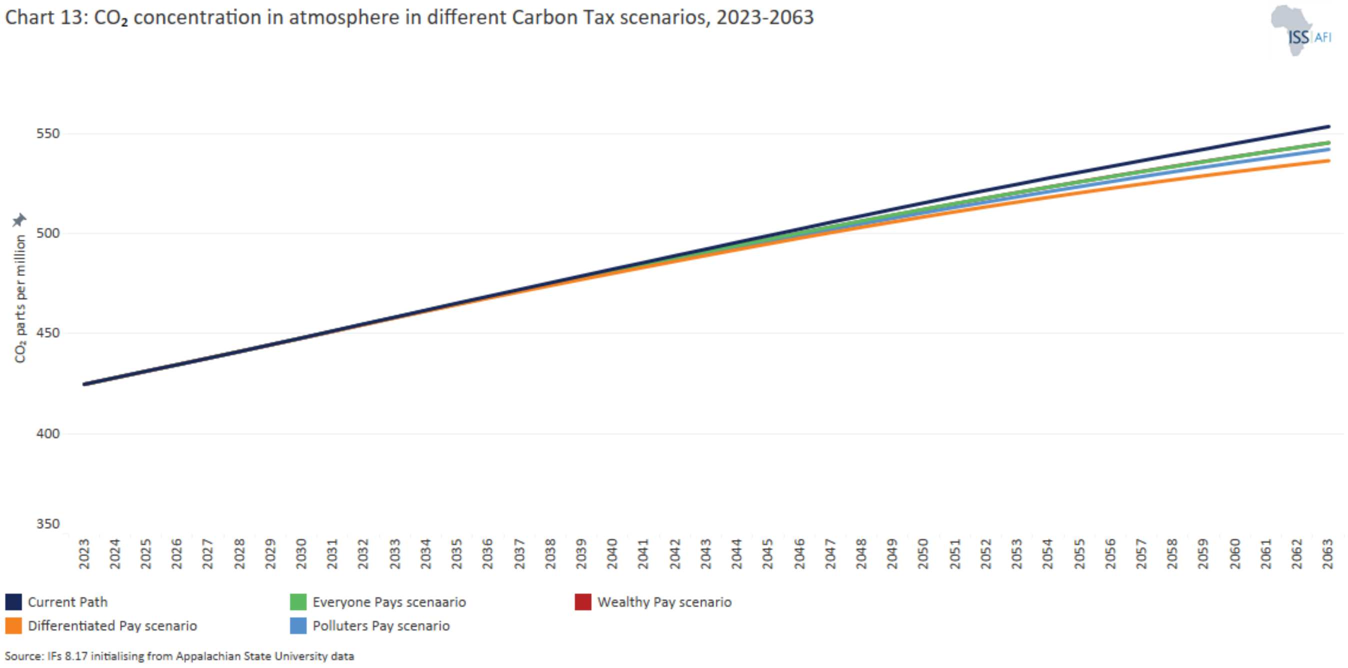
Implementing a differentiated carbon tax, as outlined in the Differentiated Pay scenario, demonstrates a promising avenue for achieving a more rapid and substantial reduction in global carbon emissions. The scenario leads to a one-year earlier emission peak than the Current Path forecast, followed by a swift decline. The most significant reductions are by China, India, USA, Russia, Brazil, Canada, Indonesia, Japan, Mexico, and Turkey, which collectively contribute to a significant reduction in emissions, given their positions among the world's top 20 polluters. By 2050, CO_2 emissions decline from 36 billion tons to 31.2 billion tons. However, implementing such a differentiated carbon tax requires careful management due to its varying impacts. The impact on each country under a carbon tax regime hinges on its ability to navigate the transition effectively, invest in clean energy alternatives (modelled in the next section) and implement policies that foster economic resilience and sustainability.

Chart 12: CO_2 emissions from fossil fuels in different Carbon tax scenarios, 2023-2063



Source: IFs 8.17 initialising from Appalachian State University data

Chart 13 shows the impact of the four Carbon Tax scenarios on CO concentration in the Earth's atmosphere.



The result of the most impactful scenario, the Differentiated Pay scenario, is that atmospheric carbon dioxide levels could be 3.4% lower in 2063 than the Current Path forecast, with up to 0.2^{o}C lower average global temperature. Given the dire situation a carbon tax is only one of several policies, tools and measures needed to tackle the global climate crisis and, on its own, would be wholly insufficient to reduce accumulated carbon in the atmosphere to the desired levels. Additional measures such as carbon sequestration (natural and technological processes), a swift energy transition, particularly in the top 20 global emitters and behavioural changes are necessary to get the world to atmospheric carbon concentrations of 330 - 400 ppm by 2050, which would be in-line with the IPCC's 6AR of a 1.5^{o}C limit.

African countries will only introduce a carbon tax as part of global efforts. The African Energy Policy scenario presented in the next section models a range of African policies, but it does not include a carbon tax despite its global importance.

Alternative measures to reduce carbon emissions

For Africa, forest regeneration and retaining vast savanna and grassland areas can play a critical role in reducing carbon emissions through sequestration and storage.

Carbon sequestration is the process of capturing atmospheric carbon dioxide (CO_2) and storing it in a way that prevents it from being released back into the atmosphere, thereby reducing greenhouse gas concentrations and mitigating global warming. It can occur naturally, as in the growth of plants through photosynthesis, or through artificial means, such as the capture and storage of CO_2 from industrial sources before it reaches the atmosphere.

Carbon storage refers to the long-term holding of carbon in stable reservoirs, including forests, soils, oceans, and underground formations such as depleted oil and gas fields or deep saline aquifers. The goal of carbon storage is to securely contain the carbon for extended periods, preventing its release and contributing to climate change mitigation efforts. While both processes are integral to efforts to combat climate change, sequestration focuses on the initial capture of carbon, and storage involves the retention of this carbon over the long term.

Nature stores significant amounts of carbon in the Earth's soils, which is vital in carbon sequestration. The health of soils is closely linked to carbon preservation, and efforts to reduce soil erosion are crucial in maintaining the effectiveness of carbon sequestration processes. Soil erosion and poor farming practices threaten this natural carbon sink, as it can lead to the degradation of soil quality and the release of stored carbon into the atmosphere.

Photosynthesis, the process by which plants absorb carbon dioxide and convert it into biomass, is a natural mechanism for capturing and storing carbon. Deforestation and poor land management practices disrupt this process by reducing the number of trees, grass and other plants available to absorb carbon dioxide. It diminishes the Earth's natural capacity for carbon sequestration and releases stored carbon when, for example, trees are cut down or burned. Protecting, conserving, restoring, replanting and managing these carbon sinks are thus vital in mitigation and sustainability efforts. Forests, in particular, act as a significant carbon sink, removing an estimated 2.6 billion metric tons of carbon dioxide from the atmosphere annually, but are under constant threat from Africa's growing population that need cheap, low-technology fuels and land for agriculture.

In addition to soil erosion and deforestation, desertification represents another significant challenge to carbon sequestration efforts.[1] As arable land transforms into deserts, the ability of the soil to retain carbon diminishes, contributing to the decline in natural carbon sequestration capacity. Desertification is estimated to affect around 45% of Africa's land areas, significantly affecting the Sahel. Various policies aim to buttress reforestation, such as the EU Deforestation Regulation (EUDR), which comes into force late in 2024. Under EUDR, importers of commodities like coffee, cocoa, soy, palm, cattle, timber and rubber - and products that use them - must be able to prove their goods did not originate from deforested land or face hefty fines. The efficacy of these measures requires in-depth exploration, however.

Artificial carbon sequestration technologies have also gained prominence recently, including technologies such as Direct Air Capture (DAC) and Carbon Capture and Storage (CCS). It is a rapidly growing industry that in 2022 received a record investment of US$6.4 billion, double the amount received in 2021. CCS have the most considerable potential when applied to industrial 'point' processes before carbon reaches the atmosphere, such as cement, steel, pulp and paper, chemicals and natural gas processing, but it is expensive. These are all significant emitters of CO_2, accounting for around 25% of global energy-related CO_2 emissions. CCS technologies have, on the one hand, been applauded, mainly by the oil and gas industry, for their innovation and ability to decarbonise heavy emitting industries, while on the other hand, heavily criticised as a greenwash attempt in what many fear will only extend the fossil fuel era instead of ending it. Still, capacity has grown by 44% between 2022 and 2023 and as of September 2023, there were 39 large-scale CCS facilities worldwide in operation, with 20 in construction and another 98 in an advanced development phase. Most of these projects are in North America and are part of the US petroleum and gas industry.

In addition to application to cement and fertiliser production plants, reducing illegal gas flaring in countries such as Nigeria, Algeria, Angola, Cameroon and Egypt would play an essential role in Africa. The IEA forecasts that CCS capacity could increase in the coming decades, reaching 1.5 gigatons of CO_2 per year by 2030 and potentially exceeding 5.6 gigatons by 2050 (equivalent to 1.5 bn ton of carbon equivalent), most from point capture from cement production and power generation. The Agency subsequently set out a range of policy recommendations for CCS development and deployment. The Chair of the Energy Transitions Commission believes that CCS could capture or store about 4 Gt of CO_2 a year by 2050 (equivalent to slightly more than 1 Gt of carbon equivalent), much of that applied to industrial processes.

According to IEA executive director Fatih Birol, the potential for so-called direct air CCS systems to capture and store enough carbon emissions from the atmosphere at a sufficient scale to allow for ongoing oil and gas production is, however, a fantasy. The implication is that more than 85% of emission reductions have to come from cutting fossil fuel use and less than 15% from carbon capture.

Due to the associated costs and technical barriers, the widespread deployment and adoption of CCS technologies in Africa is in its infancy. Nigeria and South Africa, as Africa's largest carbon emitters, have the potential to become players in the carbon capture and storage markets, with South Africa currently having several pilot projects in the coal power sector.

Endnotes

1. The most ambitious transboundary project in Africa to fight desertification, land degradation and climate change is the Great Green Wall (GGW) initiative introduced in 2007 by the African Union. The project aims to restore 100 million hectares of degraded land, capture 250 million tons of CO2 and contribute to creating 10 million jobs by 2030. At the COP26 conference in 2021, the EU reconfirmed their commitment to the GGW with an additional annual commitment of US$ 700 million, pushing the global commitments to this programme to €19 billion.

Donors and sponsors

Hanns Seidel Foundation · Sweden Sverige · AUDA-NEPAD African Union Development Agency · Humanity United

Cite this research

Alize le Roux and Jakkie Cilliers (2024) Climate. Published online at futures.issafrica.org. Retrieved from https://futures.issafrica.org/thematic/14-climate-change/ [Online Resource] Updated 11 April 2024.

About the authors

Ms Alize le Roux joined the AFI in May 2021 as a senior researcher. Before joining the ISS, she worked as a principal geo-informatics researcher at the CSIR, supporting various local and national policy- and decision-makers with long-term planning support. Alize has 14 years of experience in spatial data analysis, disaster risk reduction and urban and regional modelling. She has a master's degree in geographical sciences from the University of Utrecht, specialising in multi-hazard risk assessments and spatial decision support systems.

Dr Jakkie Cilliers is the ISS's founder and former executive director of the ISS. He currently serves as chair of the ISS Board of Trustees and head of the African Futures and Innovation (AFI) programme at the Pretoria oce of the ISS. His 2017 best-seller Fate of the Nation addresses South Africa's futures from political, economic and social perspectives. His three most recent books, Africa First! Igniting a Growth Revolution (March 2020), The Future of Africa: Challenges and Opportunities (April 2021), and Africa Tomorrow: Pathways to Prosperity (June 2022) take a rigorous look at the continent as a whole.

About African Futures & Innovation

Scenarios and forecasting can help Africa identify and respond to opportunities and threats. The work of the African Futures & Innovation (AFI) program at the Institute for Security Studies aims to understand and address a widening gap between indices of wellbeing in Africa and elsewhere in the world. The AFI helps stakeholders understand likely future developments. Research findings and their policy implications are widely disseminated, often in collaboration with in-country partners. Forecasting tools inspire debate and provide insights into possible trajectories that inform planning, prioritisation and effective resource allocation. Africa's future depends on today's choices and actions by governments and their non-governmental and international partners. The AFI provides empirical data that informs short- and medium-term decisions with long-term implications. The AFI enhances Africa's capacity to prepare for and respond to future challenges. The program is headed by Dr Jakkie Cilliers.