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POLICY BRIEF

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Science-Economic Diplomacy: Harnessing the African Continental Free Trade Area (AfCFTA) to Promote Indigenous Technological Capabilities

Executive summary

Africa has achieved very few scientific discoveries and innovations that have gained global recognition, despite the immense potential of its indigenous assets, products and services. Much of this potential remains locked within the small and medium-sized enterprises (SMMEs) market, which faces significant challenges, including a lack of recognition, organisation, support, and protection. South Africa became the first South African Customs Union (SACU) country to trade under the African Continental Free Trade Area (AfCFTA). This milestone is a significant symbolic gesture, showcasing South Africa's leadership as both a regional and continental powerhouse. The lack of industrialisation in Africa, coupled with lower intra-trade levels can indeed be attributed to limited exposure, nurturing and protection of indigenous technological capabilities. The positive relationship between trade, innovation, and industrialisation is well-supported by scientific evidence. South Africa's industrial exports, particularly within the African continent, hold potential to propel technological progress.

Accordingly, science-economic diplomacy offers a great opportunity for the South African government to harness the AfCFTA to promote indigenous technological capabilities, the lack of which has been a thorn in Africa's pursuit of industrial development. The country is uniquely poised, not only as the continental hegemony, but also as the 'science diplomacy capital for Africa', demonstrating that it embraces its status as a leader in the continent. However, this comes with a great deal of responsibility. Properly harnessing the AfCFTA will facilitate technological capabilities, enable the development of innovative industries, and promote the production of high-value goods. This policy brief contends that science-economic diplomacy could propel technological capabilities in production across the continent, with South Africa playing a leading role. It is for these reasons that efforts and substantive investments must be directed toward supporting the finalisation and implementation of instruments, such as the draft Intellectual Property Rights (IPR) Protocols, including the AfCFTA Digital Trade Protocol. Such instruments are critical for fostering impactful cooperation in the enforcement of IPRs. They play a vital role in enhancing Africa's competitiveness through the adoption and integration of technological solutions.

Introduction

Although modest, South Africa's industrialisation and technological capability has some foundational elements in place. These foundations are evident in several essential areas, such as intellectual property rights law, trading law, patents, copyrights, industrial designs, and associated legal regulations, as well as customs operations and aligned trade systems, including competition policy. It is not surprising therefore that South Africa became the first Southern African Customs Union (SACU) country to trade under the African Continental Free Trade Agreement (AfCFTA), demonstrating its longstanding commitment to play a leading role in increasing intra-Africa trade. With the AfCFTA on the horizon, the lack of indigenous technological capabilities for commodity beneficiation remains the primary challenge for South Africa, as well as other African economies. This is among the most consistently cited sources for lack of development in most African countries, as scholars and policymakers alike have been scrambling to reconcile the vast natural resources that co-exist with unsurmountable poverty levels. The richest continent in terms of commodities, being home to some of the poorest countries in the world, characterised by persistent economic and political instability, has fortified claims of the resource curse theory.[1] What has remained true is that the lack of resource beneficiation and the exportation of raw materials has created a dependency syndrome for the countries on the continent, and South Africa is no exception.

Policy context

Considering Africa's abundance of indigenous assets and resources, such as plants, medicines, genetic resources, the protection and safeguarding of intellectual property rights are long-overdue for both the actors operating in the information and formal trade markets. Building on the above background, the AfCFTA offers a great opportunity for groundbreaking scientific collaboration. This approach would not only contribute to South Africa's re-industrialisation process but also advance its continental agenda.

1. The proponents of this theory assert that countries with abundant natural resources often suffer negative political and socio-economic outcomes from the exploitation of these resources.

This is important because as South Africa is posing as a leader of the African continent in the quest for economic integration through initiatives like the AfCFTA, it cannot succeed unless there is something to trade, other than commodities, with other African countries in order to increase intra-continental trade.

Conceptually, the interface between science and economic diplomacy refers to the state deploying foreign policy to meet its economic and sustainable development objectives through scientific collaboration and technological transfers. This interface exists because science, regarding the importance of innovation systems in any form of development, cannot be emphasised enough. To make this point, we need to look no further than the role of science in the First Industrial Revolution in Great Britain, innovating the steam engine, which culminated in mass production, or the Second Industrial Revolution, marked by electrification, the Third Industrial Revolution characterised by computation and, of course, the Fourth Industrial Revolution driven by automation. Thus, this policy brief argues for the integral role of science-economic diplomacy in the industrialisation process of countries; this case has been made repeatedly in the past, and supported by evidence throughout economic development history. The idea here is to show how South Africa can use this to propel its national and continental development agenda at a time when groundbreaking innovation has become more critical than ever with the advent of economic globalisation.

Science-economic diplomacy nexus

While there is a long history of the interface between science and diplomacy, Science Diplomacy is relatively new[2], and usually classified as a 21st-century phenomenon. As a concept, it means integrating science and diplomacy to foster international cooperation and advance socio-economic progress; that is, using science, technology, and innovation, including scientific collaboration to strengthen the relations between countries and meet mutual foreign policy interests.[3] Alternatively, economic diplomacy speaks to the government's use of strategic resources in pursuit of the country's economic interests, promoting trade arrangements, attracting investments, and facilitating bilateral and multilateral economic agreements.[4]

Given its foundation in industrialisation capabilities, processing-manufacturing potential, strong transport-logistics networks, emerging digital trade and technological innovation, South Africa should play a leading role in developing and trading high-tech merchandise, as well as promoting the regional value chains (RVCs) within the context of the AfCFTA. The idea is not to make a case for regional economic integration in Africa, not only because that is not the intent of this policy brief but mainly because it has long been established, with remarkable consensus among academics and policymakers, that the economic sizes of several African countries make integration the most viable approach towards sustainable economic growth and development. That is to say, the collective approach to finding solutions for common problems predates the neo-liberal economic globalisation wave in Africa. Accordingly, as the AfCFTA seeks to promote the free flow of goods and services, as well as production factors, including labour and human capital, this could be utilised to facilitate groundbreaking scientific collaborations.

2. Vaughan Turekian, 'The Evolution of Science Diplomacy', *Global Policy,* 9(3), 2018, 5–7. Available at: https://doi.org/10.1111/1758-5899.12622
3. Royal Society and AAAS. *New frontiers in science diplomacy: Navigating the changing balance of power,* 2010. Available at: papers://83b91c39-4ef8-4e0e-9ba2-0f743f221ffe/Paper/p9068
4. Maaike Okano-Heijmans, 'Economic Diplomacy', 2016, inn *The SAGE Handbook of Diplomacy*. Available at: https://www.defence.lk/upload/ebooks/The-SAGE-Handbook-of-Diplomacy.pdf#page=591

Research method and approach

This policy brief emerges from an in-depth analysis of existing data sources, such as strategies, annual progress reports, other publications of the relevant entities, and respective policies and strategies.

Results and policy implications

Science-economic diplomacy and technological advancements in (South) Africa

There are two primary considerations worth pointing out:

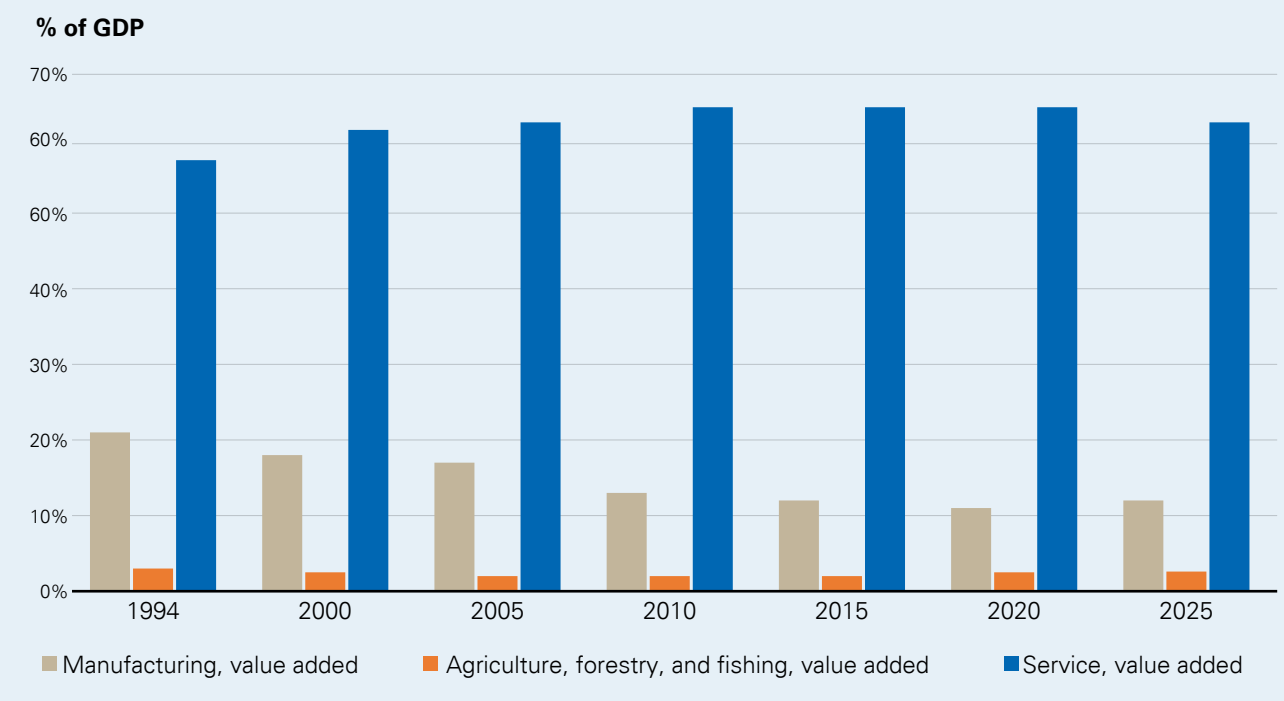
1) A free trade arrangement, in itself, does not guarantee industrialisation.

2) A free trade arrangement does not necessarily lead to increased trade among member states.

The extractive sector (primary economic sector) is the leading contributor to the GDP of several countries in Africa. Historically, these resources have been exported to former colonising powers with little or no processing. This has left these countries with a limited industrial and manufacturing bases; sectors that are important for any country seeking to achieve sustained growth and strong development models.

Concerted efforts by the colonising powers went into designing the structure of the African economies to serve their interests. Thus, the market forces alone cannot promote the structural transformation required across Africa. Concerted policy measures are required to enforce this structural transformation. This would facilitate a fundamental shift in the composition of these economies, reducing the over-reliance on the unsustainable primary and extractive sectors. In their place, a diversified economic framework would emerge, with each sector making a reasonable contribution to the country's Gross Domestic Product (GDP).

Figure 1: Sectoral composition of the South African economy (%) 1994–2023



Source: World Bank, 2024

Figure 1 depicts the structural composition of the South African economy between 1993 and 2023, with the data extracted from the World Bank's World Development Indicators.[5] Two major aspects of what the data shows are striking: the first is that South Africa has not structurally transformed its economy since the advent of democracy, and the second is that the country has been deindustrialising since then. The services sector has been, by far, the major contributor to the country's GDP, as its share has never gone below 60 % since the year 2000. On the contrary, manufacturing has consistently declined, signalling de-industrialisation. The Department of Science and Innovation's Decadal Plan,[6] serving as the implementation blueprint of the White Paper on Science, Technology and Innovation, correctly stresses the need to modernise the strategic sectors of the economy, especially agriculture[7].

While the modernisation of the economic sectors is important, industrialisation, supported by advanced technological advancements, remains indispensable in the quest to reduce poverty, alleviate inequality, and create employment. There is a direct relationship between technological advancement and (re) industrialisation. The major setbacks suffered by South African manufacturing over the past two decades have been exacerbated on two fronts: the continuous reliance on mineral resources like gold and diamonds and continuous lagging in global technical advancements. Furthermore, the lack of indigenous refining capacity further exacerbates the issue.

The pitfalls of technological dependency in the 21st century economy

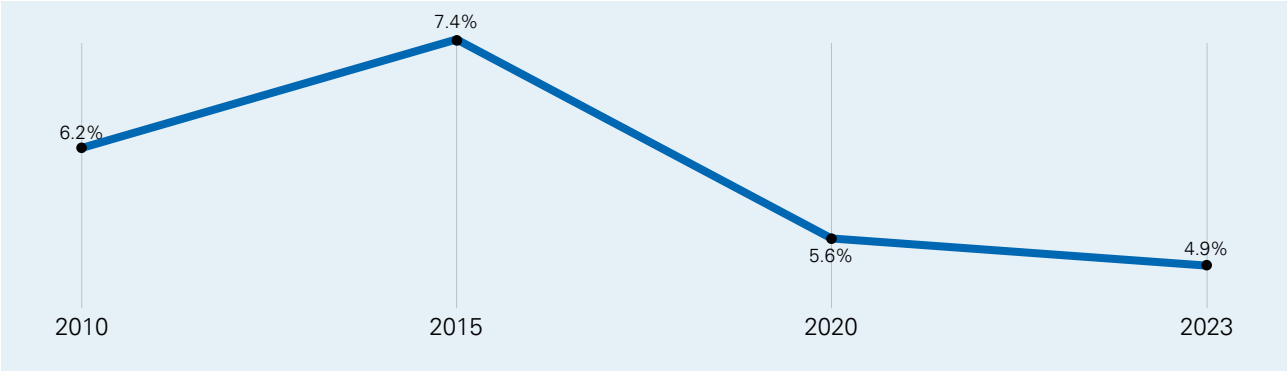
When an economic crisis occurs, the degree of impact on a country's economy is closely tied to its level of integration into the global economy and the nature of that integration. For South Africa and many other African countries, their economic vulnerability stems largely from the space they occupy in the international division of labour. As a raw material supplier to the global north economies, this has meant that the fluctuating demand and volatility of commodity prices make it nearly impossible to develop sustainable economies. A case in point is the rise in commodity demand by India and China in the first half of the 21st century, and, of course, this was a result of the economic models that these two countries pursued at the time. Several countries in Africa enjoyed some economic growth at the time. However, as these Asian countries changed their economic models, the demand for these commodities declined, and African economies took a major hit, with growth rates slowing substantially.

Figure 2 depicts South African high technology exports as a share of manufactured exports between 2010 and 2023. While there was an improvement from 2010 at 6,2 %, it peaked in 2015 at 7,4% and has steadily declined ever since. In contrast, Figure 3 depicts the merchandise imports from high-income economies as a share of the total merchandise imports. Over 50% of the country's merchandise comes from industrialised economies in the global north. It is commendable that the percentage declined from 82,4 % in 2000 to 51,4% in 2020. However, there is still a long way to go in transforming the country's economy to eliminate this dependency.

In essence, South Africa's technological dependency continues to expose its vulnerability to declining terms of trade. This cycle involves exporting primary commodities to industrialised economies and then buying them back as merchandise at higher prices. The development of indigenous technological capabilities to refine and process these commodities would not only see a transformation in this longstanding structure of African economies but also engender a higher and more respectable standard of living for the people of Africa. The AfCFTA offers the continent several avenues to pursue this, with South Africa's influential role as a continental leader.

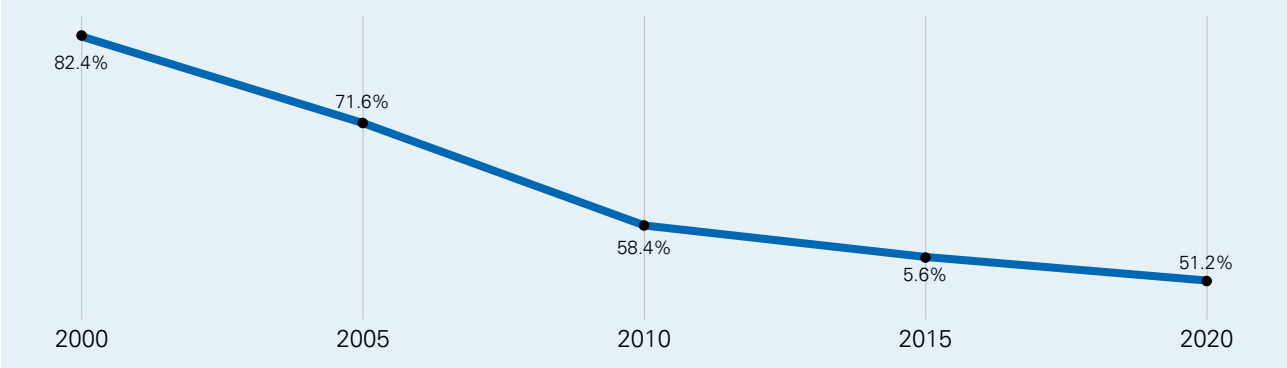
5. World Bank, ***World Development Indicators***, 2024. Available at: https://databank.worldbank.org/source/world-development-indicators#
6. Department of Science and Innovation, Science, Technology and Innovation Decadal Plan 2022-2032, 2024. Available at: https://www.dsti.gov.za/index.php/documents/strategies-and-reports/189-sti-decadal-plan
7. Department of Science and Technology, White Paper on Science, Technology and Innovation, 2019. Available at: https://www.dsti.gov.za/images/2019/White_paper_web_copyv1.pdf

Figure 2: South Africa high-technology exports (% of manufactured exports)



Source: World Bank, 2024

Figure 3: South Africa's merchandise imports from high-income economies (% of total merchandise imports)



Source: World Bank, 2024

The importance of developing indigenous technological capabilities

A positive relationship exists between trade, innovation and economic growth. Not only does trade support technological innovation and sharing, but its spillover effects extend across multiple economic sectors.[8] From these findings, it can be deduced that an organised trade arrangement within economic integration could prove even more beneficial in promoting technological capabilities. For instance, a 2011 study that investigated the effect of a free trade area (FTA) on technology innovation, using the case of the North Atlantic FTA (NAFTA) and the Association of South East Asian Nations (ASIAN), argued that within the context of the FTA, three major approaches facilitate technological spillover effects: competition, imitation and demonstration.[9]

Accordingly, the AfCFTA will facilitate a strategic steering and re-orientation of existing industries in South Africa and across the continent, where industrial exports would become the most important and effective instrument for promoting technological progress. In turn, this engenders a long process of changing the structural composition of these economies. Mensah and Ndubuisi,[10] note that technological capability leads to the assimilation of existing knowledge and technologies to create new ones, which stimulates the invention of new machinery, processes and tools and ultimately

8. Kweku Adams, et al., African Continental Free Trade Area and Regional Trade in ICT and Digital Technologies (2024). Available at: https://doi.org/10.1016/j.intman.2024.101156
9. Li Ping and Kong Shuai, The effect of free trade area on technology innovation: An analysis of mechanism and empirical test', 2011 International Conference on E-Business and E-Government, 1715–1718. Available at: https://doi.org/10.1109/ICEBEG.2011.5881855
10. Emmanuel Mensah and Gideon Ndubuisi, Technological Capability and Industrialisation. In World Development (WP 2024-03; SARChI Industrial Development Working Paper Series). Available at: https://www.uj.ac.za/wp-content/uploads/2021/10/sarchi-wp2024-03-mensahlj-ndubuisi-technological-capability-17032024-correct-isbn.pdf

drives industrialisation. Technological capabilities foster innovation by providing a foundation for research and development (R&D). Innovation, in turn, drives industrialisation by introducing new products, processes and business models that improve overall efficiency and create a competitive advantage.

Policy gap: Modern solutions to historical challenges

It is fitting to say that science diplomacy is the most viable means for South Africa and the African continent to solve the historical socio-economic challenges. As aptly put in the Royal Society and American Association for the Advancement of Science (AAAS) report, "Science Diplomacy has never been more important to deal with the defining challenges of the 21st century."[3] Modern solutions to historical challenges in this context mean that while we are often tempted to look at the so-called Asian miracle of the 20th century for 21st-century economic problems and other challenges in Africa, these may no longer be relevant. This is not only because several of these models were applied in different contexts and circumstances to the peculiarity of a continent like Africa but also because the international operating environment has changed quite significantly. The policy space has shrunk, and many of the policy measures used by Asian economies now contradict the international rules system.

Thus, simply emulating models that worked in other contexts is no longer an option; it is important to carefully study the local contexts and develop the measures and initiatives accordingly. At this point, the required policy model would ensure that the current AfCFTA does not become one of countless initiatives adopted in Africa that have never met their objectives. Properly harnessing the AfCFTA will facilitate technological capabilities, enable the development of innovative industries, and produce high-value goods. To be effective, science-economic diplomacy requires a firm institutional arrangement.

Policy recommendations

With the abovementioned in mind, this policy brief makes the following recommendations:

- **Collaborations for impact and IP rights enforcement:** Reinforcing collaboration between academia, industry and governments within the context of the AfCFTA, would not only streamline spillover technological innovations but also improve research and productivity. This collaboration should include specialists in mineral resources, cultural heritage and creative agencies, as well as academic and research institutions specialising in diverse traditional medicines and remedies covering the broader public health spectrum.
- **Strengthen governance and policy alignment:** Developing policies to reinforce science diplomacy within the framework of AfCFTA would also reduce duplication rates of innovation activities, including technological advancements and R&D. Synchronising trade and industrial policies should prevent members from designing industrial policies that work against each other, which could end up derailing the AfCFTA.
- **Invest-in infrastructure and incentivise innovation:** South African trade and industrial policies that promote trade within continental economies under the framework of the AfCFTA have the potential to strengthen innovation supply and promote indigenous technological capabilities. Enabling national and regional interventions aimed at actors in the informal trading space hold massive potential to facilitate greater access to market and enhance beneficiation through the IP protection and enforcement mechanisms.
- **Invest in industrial capacity building:** Policy initiatives to deliberately improve technological capabilities across African borders through RVCs are critical for advancing continental industrial and economic integration. The ongoing capacity building initiatives should also target judicial, customs/border officials and other selective law enforcement units. In addition, capacity development should target SMMEs, including start-ups and innovation and technology incubators.
- **Integration of regional trade and investment strategy:** Strengthening policies on scientific collaborations in a structure like the AfCFTA would streamline the identification of technologies to suit specific African production conditions. Regional integration and investment strategies across Africa should prioritise the protection and promotion of intellectual property rights, reflecting interest, awareness and care for this important aspect of development. Thus, diverse collaborations should foster a synergy between corporate, governmental bodies, and the informational sector.

Conclusion

Besides nurturing cooperations in trade and industrial advancement, the protection of IP rights must be regarded as a catalyst within the context of the sustainable development agenda. Though the promotion and enforcement of IPRs protocols have the potential to protect the rights of most vulnerable producers of indigenous assets, measures must be put into place to prevent these protections from becoming obstacles for new entrants in the trading space. Certain sectors, like agriculture, deserve attention as they host a large number of community-based SMMEs. These enterprises, through the application of emerging agritech solutions and smart farming practices, have the potential to facilitate spatial beneficiation.

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References

1. Adams, K., Attah-Boakye, R., Yu, H., Chu, I., and Mali, D. *African Continental Free Trade Area and Regional Trade in ICT and Digital Technologies*, 2024. Available at: <https://doi.org/10.1016/j.intman.2024.101156
2. Department of Science and Innovation, *Science, Technology and Innovation Decadal Plan 2022-2032*, 2024. Available at: https://www.dsti.gov.za/index.php/documents/strategies-and-reports/189-sti-decadal-plan
3. Department of Science and Technology, *White Paper on Science, Technology and Innovation*, 2019. Available at: https://www.dsti.gov.za/images/2019/White_paper_web_copyv1.pdf
4. Li, P., and Shuai, K. 'The Effect of Free Trade Area on Technology Innovation: An Analysis of Mechanism and Empirical Test', *2011 International Conference on E-Business and E-Government*, 1715–1718. Available at: <https://doi.org/10.1109/ICEBEG.2011.5881855
5. Okano-Heijmans, M. 'Economic Diplomacy', in *The SAGE Handbook of Diplomacy*, 2016. Available at: <https://www.defence.lk/upload/ebooks/The-SAGE-Handbook-of-Diplomacy.pdf#page=591
6. Mensah, E., and Ndubuisi, G., *Technological Capability and Industrialisation*, *World Development* (WP 2024-03; SARChI Industrial Development Working Paper Series). Available at: <https://www.uj.ac.za/wp-content/uploads/2021/10/sarchi-wp2024-03-mensahlj-ndubuisi-technological-capability-17032024-correct-isbn.pdf
7. Royal Society and AAAS, *New Frontiers in Science Diplomacy: Navigating the Changing Balance of Power*, 2010. Available at: papers://83b91c39-4ef8-4e0e-9ba2-0f743f221ffe/Paper/p9068
8. Turekian, V., 'The Evolution of Science Diplomacy', *Global Policy,* vol. 9, no. 3, 2018, pp. 5–7. Available at: <https://doi.org/10.1111/1758-5899.12622
9. World Bank, *World Development Indicators*, 2024. Available at: https://databank.worldbank.org/source/world-development-indicators#