POLICY BRIEF: ASSESSING SCIENCE TECHNOLOGY AND INNOVATION METRICS IN AFRICA

The policy brief was prepared by the African Centre for Technology Studies, the Science, Policy Research Unit at the University of Sussex and the Africa Research and Impact Network.

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Assessing Science Technology and Innovation Metrics in Africa

Key Messages

Most African countries have established national STI institutions and plans, but still face challenges in translating these national plans into action due to lack of proper framework for assessing STI interventions and their contribution to development, thus impeding strategic investment approaches for Africa countries.

Research and Development (R&D) survey is a common initiative pursued by countries to assess their STI progress. African countries also engage with global initiatives for STI measurements (e.g. the OECD and UNESCO scoreboards) even though most countries still face challenges in contextualizing the indicators.

The existing initiatives are made up of input-output indicators that are aligned to countries' national systems of innovation. However, these initiatives lack framework for evaluating the effectiveness and relevance of the indicators over time.

Policy makers are the main scoreboard users in Africa even though the use is relatively ad-hoc rather than for proactive planning support. This is caused by lack of proper support systems for collecting and sustaining the data collection process. For instance the current R&D surveys performed by countries are yet to be fully institutionalized.

This brief proposes an integrated scoreboard built on a logical framework that allows the analysis of the relationship between STI inputs and outputs, their linkages, societal outcomes, and enabling conditions for desired societal outcomes. The proposed scoreboard can be developed into a web-based decision-making tool that opens up investment opportunities and enables comparability and learning among countries (rather than competition among countries).

1. Background

This policy brief highlights insights on how African countries are assessing their Science Technology and Innovation (STI) metrics and recommends an integrated scoreboard for improving the assessment. The brief is based on the 'Assessing Science and Technology Metrics in Africa' project, which is aimed at developing an integrated set of indicators (scoreboard) that can be applied to assess STI progress and performance in African countries. Developing STI indicators builds on the fact that most African countries are aspiring to transition to sustainable industrialized economies by 2030 through STI, thus the need to understand which investments can yield benefits that align to this development ambition and the broader Sustainable Development Goals (SDGs). The role of STI as a driver of a knowledge-based economy and achievement of the SDGs is articulated in the continent's Agenda 2063 and operationalized under the STI *Strategy for Africa 2024* (STISA-2024).

Africa's STI landscape is characterized by mixed progress differentiated across countries[1]. A fundamental milestone is the establishment of national-level policies and agencies to guide investments, monitoring, and reporting. Most countries have established the National Science Granting Councils (SGCs), as the key agencies coordinating national STI-related activities. Additionally, these countries continue to call on the international community and the private sector to invest in their STI activities such as research and development, capacity building, and innovation centres, among others (Frost et al., 2020)[2].

However, majority of these countries still face challenges in translating these national plans into action, coupled with little evidence on what is going on in practice. Several ongoing innovative activities/initiatives within many countries are poorly documented, measured, or reported, thus lack of clarity on how interventions contribute to the countries' development in the context of SDGs. This gap impedes investments in STI from both public and private sources as investors lack information on the value of their investments. The need to develop an integrated and usable scoreboard for measuring various STI interventions, their outputs, and outcomes is urgent to clarify strategic opportunities for enhancing the continent's STI portfolios and development.

The purpose of this policy brief is to inform Africa's STI policy makers about various approaches/methodological frameworks that have been used to assess ST&I in Africa, and to recommend an integrated framework (with a set of standard key indicators) for assessing and comparing the continent's STI progress. The brief also includes some of the challenges faced by countries in measuring STI progress and recommends options to address them.

2. Methodology

The brief is built on a study that involved nine (9) main steps, with the first seven (7) steps focused on the development of a suitable scoreboard for African countries while the last two (2) steps involved uptake and decision support for countries. Guided by these steps, the study was anchored on co-production, where stakeholders were engaged in the design, review, and validation of the study activities and outcomes. The specific methods applied included: in-depth literature review; secondary data inventory including review of existing ST&I scoreboards (e.g., AIOIII, GII, OECD scoreboard, UNESCO science report, RICYT scoreboard, national scoreboards, among others); and academic literature (reviews, assessments, citing documents) in Scopus, Google Scholar, WoS, and Scielo. Specific key informant interviews (from a select number of stakeholders in Kenya, Nigeria, South Africa, Zambia, and Rwanda), and a representative sample of STI data users were interviewed in addition to exploratory on-line multi-stakeholder surveys.

3. Key Findings

3.1. Existing Initiatives for STI Measurement

In terms of existing/ongoing initiatives that attempt to measure STI in Africa, the study identified fifteen (15) scoreboards informing STI measurements from both international and Africa-specific domains. The key ones include the United Nations Economic Commission for Africa (ECA), and Africa-specific ones such as the Research & Development (R&D) and Innovation surveys conducted under the African Science and Technology Innovation Indicators (ASTII) initiative supported by African Union Development Agency (AUDA-NEPAD), among others.

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[1] African Union (2021)
[2] https://assets.publishing.service.gov.uk/media/5fca247fd3bf7f5d09db26ab/KSI_Report_FINAL_.pdf

Most African countries have adopted the Research & Development surveys. The surveys are however relatively incomplete in most countries due to lack of consistent data collection over time. The frequency of the surveys also differs across countries. For instance, South Africa has implemented six (6) surveys while others (e.g., Zimbabwe, Rwanda, and Cameroon, among others) have registered only one survey over the same period. Such disparities impede comparison and learning across countries (Figure 1).
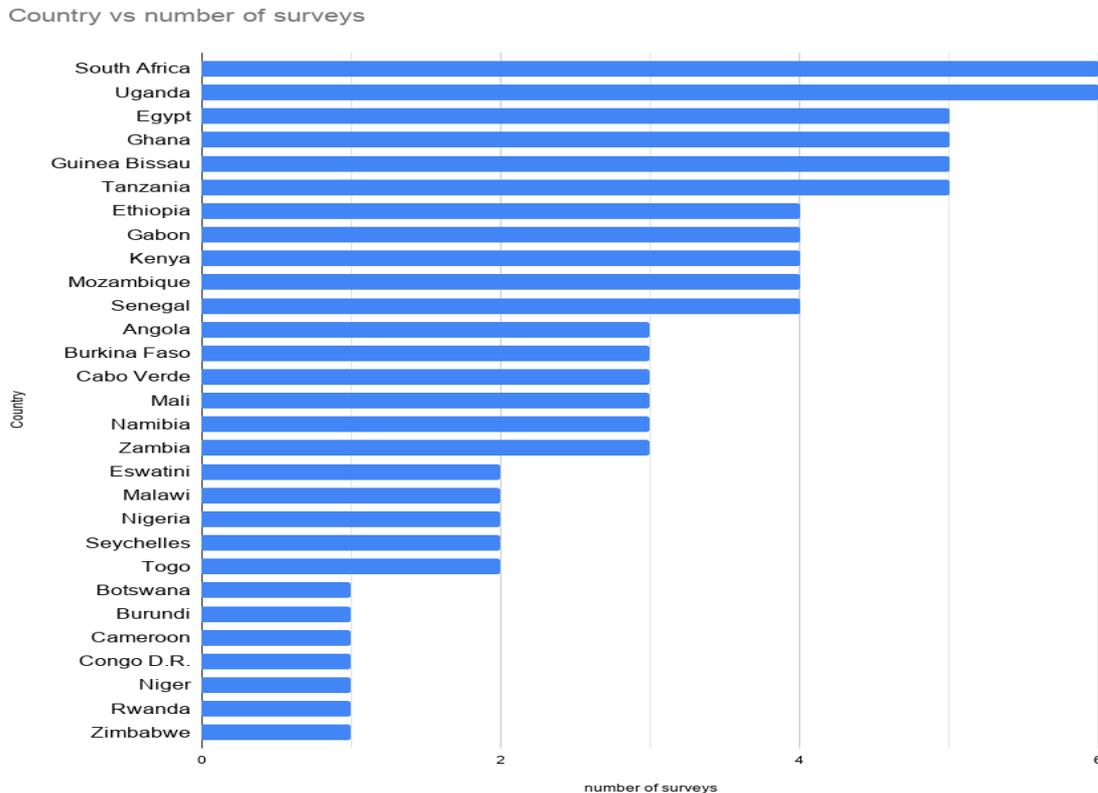

Figure 1: Number of R&D surveys undertaken by various African

The other existing scoreboards are mainly based on input-output framework and the national system of innovation. These have been extensively used to develop scoreboards and ranking STI outlooks. The scoreboards are however characterized by various limitations that negates their effective usage in African contexts. Primarily, they lack robust components for Monitoring Evaluation and Learning (MEL) thus lack feedback loops and learning opportunities. Other limitations identified include the lack of clear linkages to SDGs (i.e., only 5% of indicators relate to SDGs; lack of gender considerations, with only 3% diverging on gender and with a focus on personnel) and weak linkage/alignment to existing plans such as the STISA 2024.

The study also revealed relatively limited usage of the existing scoreboards for decision making. Policymakers are the main users of these scoreboards even though the intensity of usage by most policy bodies is relatively ad-hoc and based on specific needs rather than for planning support. The ad-hoc use is also fueled by ad-hoc data collection towards these scoreboards. The current R&D surveys performed by countries are yet to be fully institutionalized. This means that these scoreboards are yet to fully support countries in making investment decisions and prioritization, further limiting widescale usage especially by multiple stakeholders e.g., the private sector.

3.2. Proposed Integrated Scoreboard

The study builds on the situational assessment to propose a scoreboard - which can be applied to each of the 54 African countries based on the World Bank's ranking and income classification. The proposed scoreboard is anchored on a logical framework that shows the relationship between STI inputs and outputs, and their linkages and enablers linked to societal outcomes as prescribed in the National Innovation Systems approach. The framework allows for feedback loops and minimizes linearity.
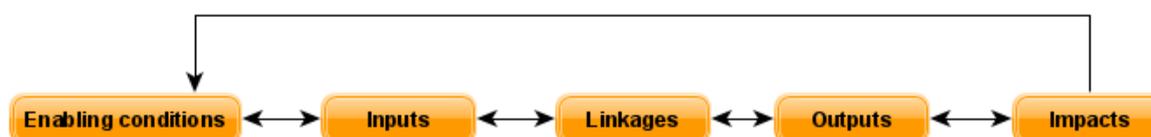

Figure 2: Framework applied in developing and integrated scoreboard

The resultant integrated scoreboard comprises 263 indicators retrieved from fifteen (15) STI-related scoreboards based on the original data sources, even though data availability was a major constraint. The indicators were organized based on the framework categories (inputs, outputs, enablers, impacts and linkages) then assessed using the systematic quality assessment criteria of relevance, completeness, and appropriateness. The framework allows the user to filter these indicators based on specific needs, thus enhancing usability. The unique feature of the proposed scoreboard is that the user can filter indicators by their quality (i.e., relevance, appropriateness, and completeness), and monitor how these change with the other assessment criteria. The scoreboard also includes a column for Quality Ranking, which provides the mean ranking of each indicator for the criteria. Finally, the scoreboard provides a compilation of available data for all countries in the world, providing a basis for comparative analysis.

In terms of completeness, there is a generally high percentage of missing data that affects coverage and timeliness of information, further confirming the challenges identified in the initial review. In terms of appropriateness, i.e., the number of consecutive years for which the data is available allowing for comparison over time, results show that on average, countries reported data for 37% of the years in the 10-year period and varied across countries. The relevance of indicators, mainly measured through stakeholder consultations, indicate that decision making support was a key consideration on how relevant an indicator is. In this case, the Gross Expenditure in Research and Development was prioritized by many users, not only as one of the relatively easy indicators to use in STI policy processes, but because it also reflects the R&D intensity crucial for securing the intellectual property rights of innovators. The indicator also supports the tracking of R&D funding in the R&D performing countries and allows for disaggregation.

4. Challenges to assessing STI in African countries

4.1. Capacity gaps

Capacity gaps remain a challenge as the national STI agencies are either understaffed and/or lack the required technical competence. This therefore potentially limits the development, uptake and tracking of indicators. There are other practical challenges when it comes to the interpretation of scoreboards and associated data. Stakeholder emphasized the need to build capacity and skills that can contextualize relevant indicators for both formal and informal sectors.

4.2. Disintegration of STI agencies

There remains disintegration among agencies in the way that countries approach STI indicators for decision making. Different agencies are developing their own indicators, something that creates

overlaps and conflicts across STI agencies. In addition, there is the wider political landscape and long-standing STI silos, not just within countries but also at regional level, which might pose challenges to the effective systems as well as hosting and utility.

4.3. Sustainability challenges

Countries are making efforts towards indicator driven decision making. However, the current efforts are anchored on data collection and production of periodic reports. There is thus a lack of a proper framework that would ensure the sustainability of data collection, management, communication, and feedback.

4.4. Lack of data management policy

Most African countries lack in-country data management policies to guide data gathering, use, protection and overall management. There is a policy at the continental level, but this is yet to be adopted at the regional and country levels. This might impede the operationalization of STI scoreboards at the country level. There will be urgent need to develop in-country policies and mechanisms to allow for sustainability/long term strategies around how data is updated.

5. Policy Recommendations towards addressing identified challenges

5.1 Data infrastructure and policy

There is need to support the necessary infrastructure, design, and development towards making the scoreboard available on web platforms. A cross-cutting need is to provide a repository and resources for updating the data, as well as to include new indicators in the platform to achieve better coverage of the STI framework developed in this project. Additionally, there will be need to develop country data management policies to guide and legitimize the scoreboard development, management and decision process.

5.2 Institutional capacity building

Capacity needs have been captured in a separate report – developed by the Out of the Box (OTB) Africa. However, it is important to stress that both technical and administrative management of the STI indicator data is necessary to ensure a functional scoreboard. There is need to sustain in-country capacity building and strengthening processes on both core STI data collection (through surveys, desk analysis from various data sources) and analysis to produce expected indicators prior to populating information needed in the scoreboard. For research, countries must enhance support to the training of STI data scientists to ensure that the data feeds into relevant research questions, and for a community of active researchers to be developed around them.

5.3 Research and sustainability structures

There is lack of a proper framework to ensure the sustainability of data collection, management, communication, and feedback. For a functional scoreboard, there will be need to strengthen structures such as the human/institutional capacity for data collection, management and establishment of a working community of practice to support the process. Further, there is need to support research to continue developing and identifying ways to cover all dimensions of the STI framework so that Africa can count on a more complete and relevant information sources.

5.4 Sectoral and interagency harmony

There is need to build a platform that could support dialogue and inter-agency integration to minimize conflicts and politics associated with the STI assessments. Open repositories, forums, hackathons, academic events, are needed to improve the uptake of this data.

5.5 Entrepreneurship indicators to strengthen private sector linkages

While we assessed the general quality of approaches applied in assessing STI in Africa, we established that the national agencies are keen to develop new indicators/additional indicators to make the dashboard more relevant. Indicators around the state of entrepreneurship, availability of venture capital, university data, and interaction between academics and non-academics as requested by agencies such as KeNIA may not be available in the scoreboard and thus will need to be collected.

5.6. Uptake and decision support

Given the strengthens of proposes scoreboard, it is possible to harness it into a web-based decision support tool that is user-friendly for different stakeholders alongside other possible uses such as research analysis, evidence-based convening policy dialogues, and communities of practice, among others. As a way of moving this forward, the project team is already engaging with the NEPAD-AUDA to build on the Afri-look efforts and jointly establish a web-based decision-making tool from the scoreboard. The AUDA-NEPAD has been hosting the African Science and Technology Innovation Indicators (ASTII) platform which brings together efforts to support countries to monitor their ST&I progress through R&D surveys.

5. Conclusion

The resulting scoreboard provides enabling features for uptake, including decision making support and comparability among countries. This presents a paradigm shift in the way most scoreboards have been used, i.e., as a tool to compare the performance of countries. The purpose of this scoreboard, however, is not to develop a ranking of countries, given that the data is very variable in terms of quality, and again because an emphasis on rankings promotes competition instead of collaboration. We, instead, try to provide a view towards decision making and collaboration. The scoreboard provides data that is contextually and globally relevant, thus can be used to think of strategies beyond Africa. For instance, it can be used to analyze a country like Kenya with respect to potential global partners. It is possible to harness it into a web-based decision support tool that is user-friendly for different stakeholders alongside other possible uses such as research analysis, evidence-based convening policy dialogues, and communities of practice, among others.

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