IN-COUNTRY ASSESSMENT OF THE CHALLENGES AND OPPORTUNITIES ON STI WEB-BASED SCOREBOARD

KENYA, NIGERIA AND ZAMBIA

Report prepared by the African Centre for Technology Studies

In collaboration with the Africa Research and Impact Network, African Union Development Agency (AUDA-NEPAD) and Out of the Box (OTB) Africa.

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Purpose of the Report

The African Centre for Technology Studies (ACTS), the African Research and Impact Network (ARIN) and the Science Policy Research Unit (SPRU) at the University of Sussex, supported by UKAid through the Foreign and Commonwealth Development Office (FCDO), implemented a project on the "*Assessment of STI Metrics in Africa"* 2020-2021. The project developed a scoreboard, which is an excel file with drop down menu options based on a logical framework (enablers indicators, linkages indicators, input indicators, output indicators, and impact indicators). The scoreboard provides about 263 indicators sourced from various scoreboards and assessed through a quality criterion around completeness, appropriates and relevance. The scoreboard is designed to provide an evidence based decision making tool to help with policy processes.

The Science Technology and Innovation (STI) indicators are a set of statistical representation of metrics that can be deployed in assessing the current and predicting the future status of the elements in STI ecosystem of a country. To this end, we set out to develop a web based scoreboard to track and monitor the various components of the National Innovation System (NIS). A feasibility study, jointly implemented by ACTS, ARIN, African Union Development Agency (AUDA-NEPAD), and Out of the Box (OTB) Africa, pre-piloted the STI indicators and tested the feasibility of the web-based scoreboard for three countries; Kenya, Zambia and Nigeria.

Basis for feasibility study recommendations

The work of the feasibility study has involved a number of interrelated activities:

- Six virtual consultative meetings with the national agencies mandated with STI indicators, key personnel from national statistical agencies and bureaus as well as former African Science, Technology and Innovation Indicators (ASTII) staff.
- An online questionnaire for the STI agencies staff (managerial and technical) to outline capacities and capabilities for a web-based scoreboard.
- In country consultations (in person) in Kenya, Nigeria and Zambia to collect and collate stakeholder's perspectives/views on the initiative; consider broadly, types of input indicators, output indicators, impact indicators, enablers and linkages indicators as well as the general indicators that should form part of the country's scoreboard.
- Development of a dummy to inform the content of the web-based scoreboard for Nigeria.

This feasibility study proposes that the development of the web-based indicators should entail wider stakeholder consultations regionally to help select comparable indicators for different countries. The current scoreboard should leverage on data from other country processes such as national research and development (R&D) and Innovation Surveys to recommend a set of indicators to be included in the national STI scoreboard. The feasibility report also outlined the need for all indicators to reflect on the gender dimension and inclusiveness.

Given the central role of data collection in STI indicators, the web-based dashboard should be implemented with components for online data collection. Furthermore, the online data collection tool should be directly integrated to the web-based dashboard and form a data integration pipeline that will allow for as much automation as possible in cleaning and feeding data into the dashboard. To that end, this study makes proposals on staffing requirements and capacity building for the first year of implementation as well as provision of cost estimates.

Recognizing that data collection is a dynamic process that needs constant updating and may vary from country to country, the report emphasizes that each country should develop appropriate policy and institutional frameworks to aid in data collection. The starting point will be to address the siloed and non-coordination challenges for most of the agencies charged with the mandate of collecting STI data.

1.0 Introduction

While Science Technology and Innovation (STI) can drive development in Africa, the major issue has been how STI indicators can guide policy and decision making. To this end, the "Assessment of Science Technology and Innovation Metrics in Africa" set out to develop Africa-wide STI indicators. The project also assessed the quality of these indicators with the aim of supporting STI contributions to sustainable development goals (SDGs), and developing evidence-based policies. By way of the outputs, the project developed a scoreboard in an excel format and collected data available from 2009-2019 (within the last 10 years). Based on the scoreboard and the results, most African countries experience 60% of missing data and where available, only in specific periods of time. This missing data can be attributed to challenges at the institutional level, capacity issues as well as methodological challenges and limitations in the collection and aggregation of the STI indicators.

Over the last one year, ACTS, ARIN, and SPRU have been implementing the "Assessment of STI Metrics in Africa" project, where the project team set out to explore the feasibility for the uptake of a web-based platform. The project developed a scoreboard, which is an excel file with drop down menu options based on a logical framework (enablers indicators, linkages indicators, input indicators, output indicators and impact indicators). The excel scoreboard provides about 263 indicators sourced from various scoreboards, and the indicators assessed through a quality criterion around completeness, appropriates and relevance.

The scoreboard, which is a set of standard and key indicators, allows effective tracking of science, technology and innovation (STI) metrics, and ensures timeliness and accessibility to a wide range of users by making a comparable and robust assessment of STI in Africa. In

addition, the scoreboard contributes to the ongoing continental efforts through the African Union Development Agency (AUDA-NEPAD) and the African Observatory of Science, Technology and Innovation (AOSTI).

The scoreboard, while sufficient, might not be as dynamic neither allow for user interaction. As a result, a more accessible, dynamic, and user-friendly dashboard in a web-based format was desired. To this end, a pre-pilot study was undertaken to test the feasibility of the web-based scoreboard and assess the capabilities (national) for developing a web-based scoreboard. The capacities included administrative and technical, to support the hosting of the scoreboard.

A technical working group comprising of AUDA-NEPAD, ACTS, ARIN, FCDO, and a team of information technology (OTB Africa) was constituted to engage experts and target users at the national policy level to review and advise on the needs of web-based decision-making tool, the required information and functionalities. To achieve this, we explored the following specific objectives.

1.1 Objectives

1. Identify demand and needs of countries in adopting web-based decision tool by targeting specific agencies mandated with STI coordination/activities in selected countries.
2. Explore the complimentaries/overlaps in the country available data/information in taking up a web-based scoreboard
3. Explore capacity gaps, both technical, administrative, data management etc. to confirm countries pre-readiness.
4. Identify critical issues and challenges for uptake of web-based scoreboard in these selected countries.
5. Establishment of a basic online mock-up to server as a POC for the web-based dashboard

We provide a summary of the findings of the feasibility study.

1.2 The approach

As noted above, this feasibility study explores the development of a web-based scoreboard, and pre-pilots the STI web-based scoreboard based on stakeholder consultations. This report aims to provide some preliminary findings and opportunities to achieve a full pilot scale of the web-based scoreboard, especially with regard to the selection of the indicators, capacities required, and issues of governance, resources and staffing. We addressed these concerns by:

- Conducting about six consultative meetings with the national agencies mandated with STI indicators, key personnel from national statistical agencies and bureaus as well as former ASTII coordinators. Due to the nature of the study with time constrains (a pre-pilot study), we engaged much targeted users of the scoreboard, users that guide policy and decision making in selected countries.
- Conducting key informant interview with 6 informants from the national agencies.
- Carrying out an online survey to assess capacities to implement a web-based scoreboard with three groups (coordinators, operational staff and ICT Staff).
- In country consultative meetings carried out by independent consultants in Kenya, Nigeria and Zambia to assess stakeholders' choice of indicators, as well as explore challenges in relation to STI indicators.

2.0 Findings

2.1 Demand and needs of countries

In the three countries, there a growing appreciation on the use of indicators and the need to have them in a web-based platform similar to the UNESCO-GOSPIN platform, to track and to support evidence-based policy making. Based on the consultations, different agencies are trying to generate their own indicators, based on their own frameworks - most of which are already in line with the scoreboard. However, these indicators are agency driven thus need to build greater harmony among agencies towards a one integrated STI indicator system. For example, Kenya established three agencies; the Kenya National Innovation Agency (KeNIA), the National Commission for Science Technology and Innovation (NACOSTI), and the National Research Foundation (NRF), all which have been mandated with different aspects. For example, NRF's mandate lies in R&D survey while KeNIA tackles Innovation surveys.

For Nigeria, the need to develop STI indicators was spearheaded by National Centre for Technology Management (NACETEM) in 2005. The effort led to the integration of Nigeria's STI indicators initiative into NEPAD-OST (now AUDA-NEPAD) ASTII initiative in 2008. NACETEM was officially designated as the National Focal Point (NFP) and the implementing Agency for

the project by the Nigerian Government in 2008 and is responsible to date for the undertaking National R&D Survey (2019). Nigeria has extended its innovation survey to the informal sector, a number of institutions which are both producers and consumers of STI, and is expected to publish the data in the fourth Africa Innovation Outlook (AIO) in 2022. The main institutions in Zambia are the National Institute for Scientific and Industrial Research (NISIR), the Ministry of Higher Education, Universities, government agencies, and research institutes.

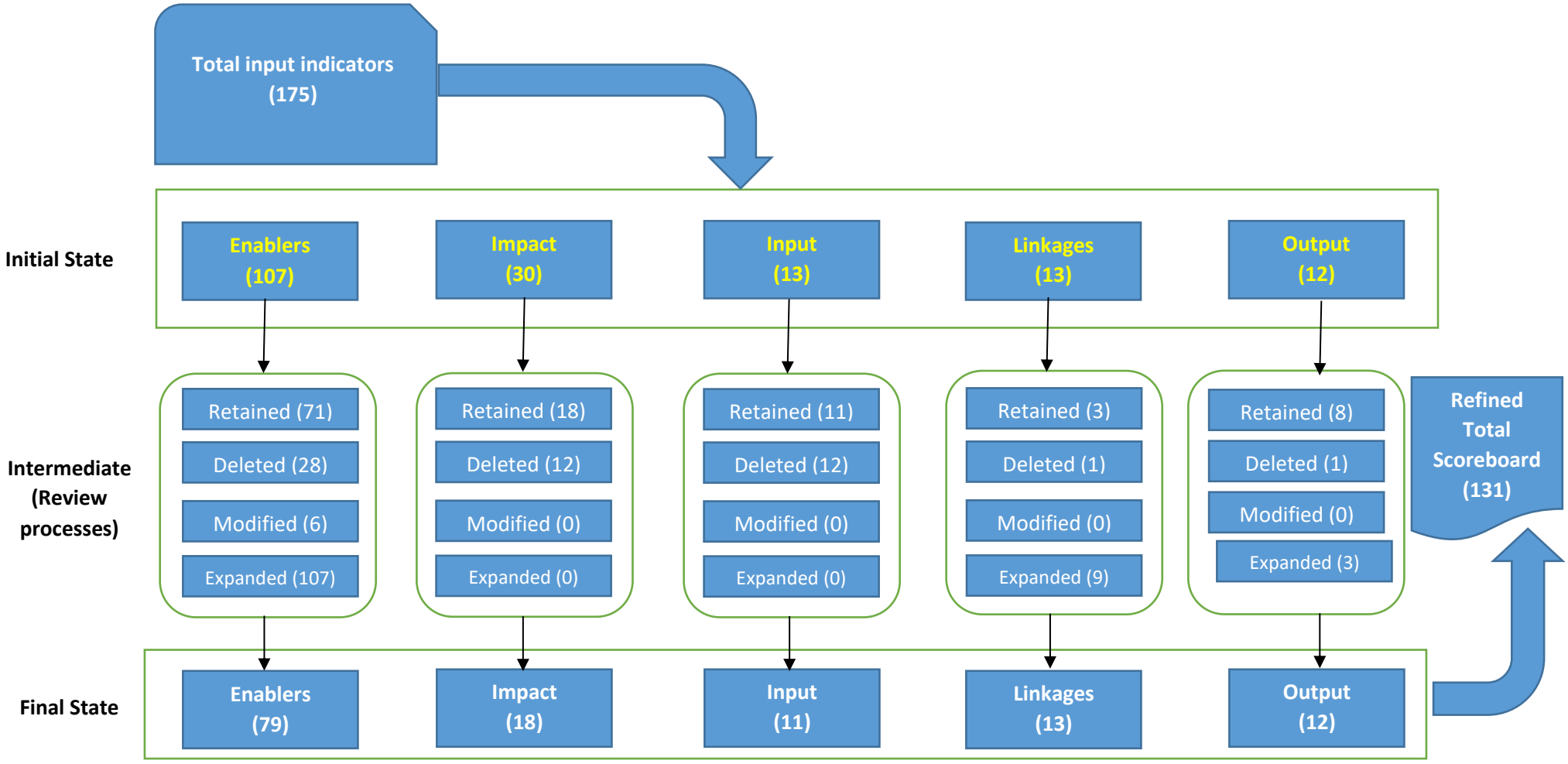
Although several agencies and institutions engage in STI, coordination and collaboration among the various stakeholders is lacking. There is no central database and guidelines for data sharing which affects reporting. Stakeholders in the three countries were elated by the scoreboard as a tool that has great potential to inform decision making, as it provides an opportunity to use the web-based system as a convening tool where agencies interact and harmonize their STI efforts.

2.2 Country Frameworks

The sets of indicators were presented based on the logical framework earlier outlined. County consultations established that countries have different frameworks that guide STI indicator selection. Kenya for example, relies on the NACOSTI framework that was jointly developed by NRF, KeNIA, and Ministry of Education. The indicators are categorized according to the following broad categories: STI expenditure, Human resources, STI environment/Output, STEM education, Firm activities, Technology and Infrastructure, and Technology Adoption. On the other hand, Nigeria's sets of STI indicators consist of five accepted dimensions: research and development (R&D), human resources, patents, innovation, and Technology Balance of Payments (TBP).

We present an illustration of the process in Nigeria that recommended inclusion of some indicators, particularly those included in their national R&D and Innovation Surveys. Some indicators were considered inadequate or inappropriate and therefore recommended for deletion. While these sets of stakeholders selected these indicators, there may still be a need to carry out empirical assessments on these indicators to ascertain their adaptabilities and ensure comparability across Africa. Africa as a continent is very heterogeneous and diverse culturally and socio-economically in terms of its business environment, political terrain, and policy diversities, and as such, achieving a set of comparable indicators will be a challenge and will require broader consultation.

Figure 1: NIGERIA STI SCOREBOARD



2.3 Complimentaries/overlaps in the country available data/information

From the country list of indicators selected, enabler indictors are prioritized in the three countries as part of the national web-based scoreboard. In Nigeria, indicators such as Gross Expenditure on Research and Development, R&D intensity, gender data, headcount and full time equivalent (FTE) of R&D personnel, and innovation propensity were selected as core. In Kenya, different agencies prioritized indicators as per their mandates. For example, KeNIA's core indicators included those addressing policies and strategies, leadership & governance, infrastructure, funding towards innovation, networks and partnerships, skills on commercialization and innovation.

While there are core indicators prioritized by different agencies, existing efforts around STI indicators and data collection are still relatively ad-hoc and one-off, and lack full operational system especially how the indicators will be operationalized and sustained - thus the need for a web-based system that captures key operational elements such as data sources, data organization, management and usability, as well as greater sustainability structures (e.g. specific capacity support, partnerships among others). Further, institutional coordination and collaboration among various agencies in the Kenya and Zambia will need to be strengthened. National data management policies become key tenets to guide and legitimize the process of scoreboard development, management and decision-making process.

While country level indicators would be good, there is still need for a selection of uniform indicators across countries to ensure comparability, similar to the current STI scoreboard developed. From the consultations, allowing countries to host their own scoreboard with different indicators will make comparability difficult. Therefore, a similar mechanism around ongoing initiatives at the African Union level allows countries to generate their own STI status, but also supports some elements of comparability to help in progress of STI in Africa.

2.4 Capacity gaps (technical, administrative, data management) to confirm countries pre-readiness

We analyzed countries' capacities to host the web-based scoreboard. While these countries have received technical support from the ASTII initiative including conducting R&D surveys, most national STI agencies are understaffed and lack the technical backstopping required, and thus unable to implement most of the data collection activities. Therefore, these national agencies and institutions may currently not effectively host the web-based platform. An organization like KENIA may require extra support for ICT Manpower whether through the implementing software vendor or onsite consultants.

2.5. Critical issues and challenges for a web-based scoreboard

2.5.1. Capacity gaps

As discussed above, the national agencies are either understaffed and/or lack the technical competence. This therefore potentially reduces follow up and the tracking of indicators already organized in a web-based format. There are other practical challenges when it comes to the interpretation of the scoreboard, the methodologies employed, data interpretation, as well as values in the scoreboard (e.g., what would negative versus positive values imply). This further skew the compiling of comparable data. Again, this echoes the need for continued capacity development at the regional/continental level to support this while also providing closer technical backstopping for quality assurance.

2.5.2. Disintegration of STI agencies

There remains disintegration among agencies in the way countries approach STI indicators for decision making. Different agencies are developing their own indicators, creating overlaps and conflicts across STI agencies. There is also the wider political landscape and long-standing STI silos, not just within countries but also at regional levels. This might challenge the effective system including hosting and utility.

2.5.3. Sustainability challenges

The countries assessed are making efforts towards indicator driven decision making. However, the current efforts are anchored on data collection and production of periodic reports. There is lack of proper framework to ensure the sustainability of data collection, management, communication, and feedback.

2.5.4. Lack of data management policy

The three countries assessed, and most of the African countries lack in-country data management policy 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 a web-based decision-making scoreboard at the country level. There will be urgent need to develop in-country policies alongside the web-based scoreboards. Once such mechanisms are put in place, they will allow for sustainability/long term strategies around how data is updated.

3. Proposed Web based System Mockup

A mockup of the proposed dashboards for each country has been developed with the data provided this far. The links are as follows:

- Nigeria: http://acts.otbafrica.com/dashboard/2/NGA/
- Kenya: http://acts.otbafrica.com/dashboard/2/KEN/
- Zambia: http://acts.otbafrica.com/dashboard/2/ZMB/

The mockup also includes a sample dashboard that combines data from the 3 countries and an extra one (Ghana) to give 'Africa-wide' insights on STI indicators. The link for this is http://acts.otbafrica.com/.

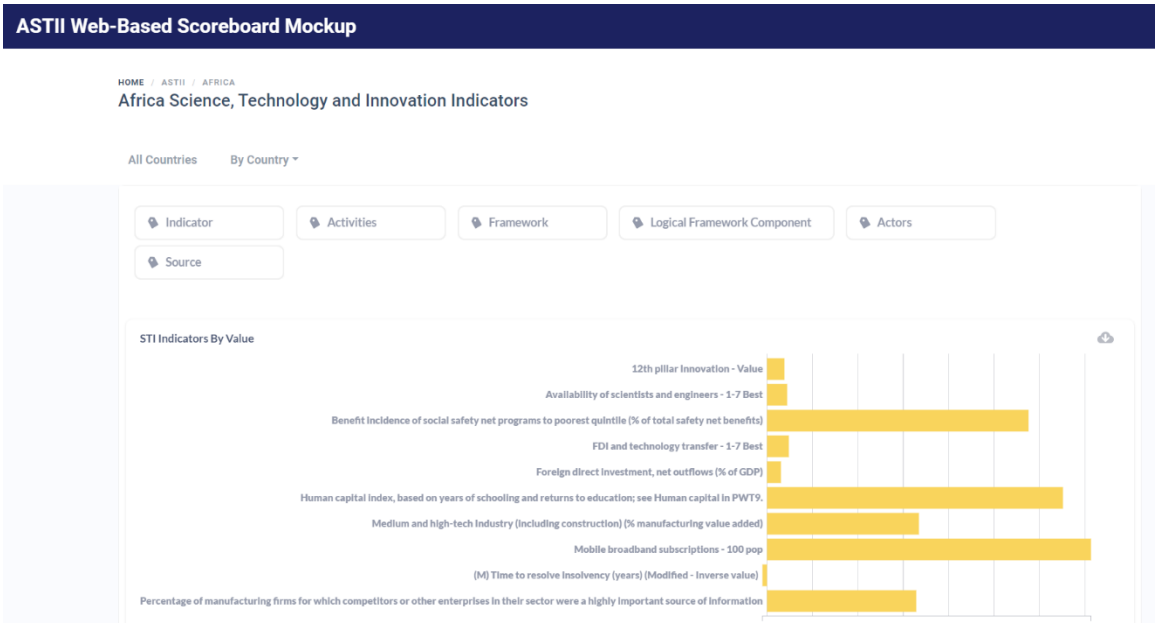


Figure 1: Web-Based Dashboard Mockup Screenshot 1

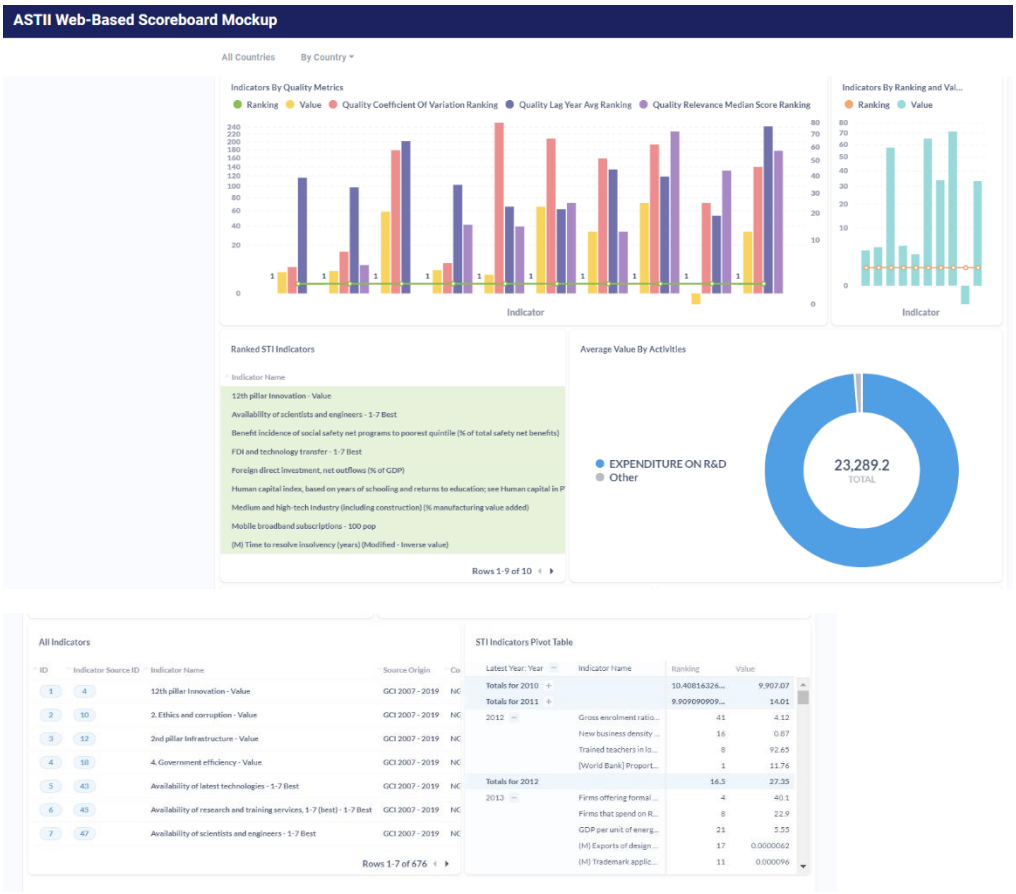


Figure 2: Web-Based Dashboard Mock-up Screenshot 2

3.1 Improvements

One of the major challenges for the success of the platform roll out is data collection. The platform needs to be fed with data that will be analyzed to give indicators that are meaningful. For this, we recommend the inclusion of an online data collection tool that will help in data collection from the identified sources. The tool will make use of online surveys that feed data directly into the analytics tool and will be available both on the web portal and as a mobile application.

With powerful APIs, the analytics tool could also integrate with stakeholder systems to pull/push data to have seamless data collection.

4. Time and Resources

It is proposed that the full project implementation can benefit from a 3 phased approach. A first phase focusing on implementing the required technology and country indicators for 3 countries. The subsequent phases will involve expanding the platform to accommodate more countries to be specified, as well as accommodate more advanced features around decision support.

5. Recommendations and strategies/actions

Overall, a web-based scoreboard is a feasible initiative that can support not only policy makers, but a wide range of stakeholders to build their understanding of STI processes and investments towards sustainable development. We recommend that a full pilot for a web-based STI tool be rolled out. The following elements needs to be taken in account when building a relevant web-based tool:

5.1 Institutional Capacity building

Capacity needs have been captured in a separate report - developed by the OTB. However, it is important to stress that both technical and administrative management of the STI indicator data is necessary to ensure a functional web-based tool. 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 for the production of expected indicators prior to populating information needed in the scoreboard.

5.2 Comparable indicator systems

While individual countries are willing to support a web-based tools by selecting own indicators, there is need to ensure country comparability as well as regional comparability. As such, the establishment of a continental web-based decision support tool would be most appropriate, and further exploring how this can be hosted to ensure access to the indicators. Further, collaborations and partnerships/synergies with ongoing initiatives and key institutions (UNESCO-GOSPIN, UNCTAD and SGCI consortium members) is needed to support the operations and utility of the web-based platform.

5.3 Sustainability Structures

There is lack of proper framework to ensure the sustainability of data collection, management, communication, and feedback. For a functional scoreboard, there will be need to strengthen structures, e.g., human/institutional capacity for data collection, management, and establishment of a working community of practice to support the process.

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 process.

5.5 Entrepreneurship indicators to strengthen private sector linkages

While we have not provided the selected/prioritized indicators in this report (yet to be concluded), we established that the national agencies are keen to have new indicators/additional indicators to make the dashboard more relevant. Indicators around state of entrepreneurship, availability of venture capital, university data, 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 Data management policy

There is need to develop country data management policies to guide and legitimize the process of scoreboard development, management and decision process.