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CONTEXTUALISING STISA-2024[1]

Five-Year Science, Technology and Innovation Plan of Action 2019-2024

[1] Science, Technology and Innovation Strategy for Africa - 2024

Supported by

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Contents

Acronyms and Abbreviations

AADP	Africa Agri-Food Development Programme
AAS	African Academy of Science
AAU	Association of African Universities
ACBF	Africa Capacity Building Foundation
ACE Impact	Africa Centers of Excellence for Development Impact
ADEA	Association for Development of Education in Africa
ADF	African Development Fund
AfDB	African Development Bank
AESA	The Alliance for Accelerating Excellence in Science in Africa
AUKNASE	African Union Kwame Nkrumah Awards for Scientific Excellence
AMCOST	African Ministerial Council on Science and Technology
APET	African Union High-Level Panel on Emerging Technologies
AOSTI	African Observatory of Science Technology and Innovation
ASTIF	African STI Fund
ASTII	African Science, Technology and Innovation Indicators
ASRIC	African Scientific, Research and Innovation Council
AU	African Union
AUA	African Union of Architects
AUC	African Union Commission
AU-C10	AU Committee of Ten Heads of State and Government (AU-C10), Championing Education, Science and Technology in Africa
AUDA-NEPAD	African Union Development Agency-NEPAD
AU-STRC	The AU Scientific Technical Research Commission
AUC-HRST	The AUC Dept of Human Resources, Science and Technology
ALC	African Laser Centre
ARIPO	African Regional Intellectual Property Organization
ASTIF	African STI Fund
CAADP	Comprehensive African Agriculture Development Programme
CAMES	Conseil Africain et Malgache pour l'Enseignement Superieur
CARI	Coalition for African Research and Innovaiton
CDC	Centres for Disease Control
CESA	Continental Education Strategy for Africa
CFTA	Continental Free Trade Area
COMESA	Common Market for Eastern and Southern Africa,
CPA	AU Africa's Science and Technology Consolidated Plan of Action
EAC	East African Community
ENQA	European Association for Quality Assurance in Higher Education
EU	European Union
FARA	Forum for Agricultural Research in Africa
GDP	Gross Domestic Product
GETFUND	Ghana Education Trust Fund

GERD	Gross Expenditure on Research and Development
HEI	Higher Education Institute
HEST	Higher Education Science and Technology Project
ICT	Information and Communication Technologies
ICSU-ROA	International Council for Science - Regional Office for Africa
IPR	Intellectual Property Right
MDGs	Millennium Development Goals
M&E	Monitoring and Evaluation
NEPAD	New Partnership for Africa's Development
NEPAD Agency	NEPAD Planning and Coordinating Agency
NSTIH	NEPAD Science, Technology and Innovation Hub
OAPI	Organisation Africaine de la Propriete Intellectuelle
PAFTRAC	Pan African Private Sector Trade and Investment Committee
PAIPO	Pan African Intellectual Property Organization
PAQAF	Pan-African Quality Assurance and Accreditation Framework
PAU	Pan African University
PIDA	Programme for Infrastructure Development for Africa
PMPA	Pharmaceutical Manufacturing Plan for Africa
R&D	Research and Development
RCM	Regional Coordination Mechanism (of the AU)
REC	Regional Economic Community
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
SADC	Southern African Development Community
SANBIO	Southern African Network for BioSciences
S&T	Science and Technology
SDGs	Sustainable Development Goals
SHAEA	Strengthening Higher Agricultural Education in Africa Programme
SHASA	Strategy for Harmonisation of Statistics in Africa
STC	Specialized Technical Committee
STC-EST	Specialized Technical committee on Education Science and Technology
STI	Science, Technology and Innovation
STISA	Science, Technology and Innovation Strategy for Africa
TETFUND	Tertiary Education Trust Fund
TVET	Technical Vocational Education and Training
TFTA	Tripartite Free Trade Area
UN	United Nations
UNECA	United Nations Economic Commission for Africa
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCO-SISTER	UNESCO System of Information on Strategies, Tasks and Evaluation of Results
UNISA	University of South Africa
WIPO	World Intellectual Property Organisation
WTO	World Trade Organisatio

Executive Summary

This top-level work plan covers the final five years, 2019-2024, of the 10-year Science, Technology and Innovation Strategy for Africa (STISA-2024). It incorporates substantive background information, both to provide a solid understanding of the issues associated with STISA-2024 and to justify its work stream components and targets. The work stream components and targets require justification as there is as yet no approved monitoring and evaluation framework or implementation plan for STISA-2024. The work plan consists of: an introduction; a section covering some overarching principles underpinning the work plan obtained through stakeholder consultation; and five work streams, namely: (i) Strategy Development and Monitoring and Evaluation; (ii) Policy and Institutional Interventions; (iii) Research and Innovation; (iv) Promoting STI Investment; and (v) STI Communication, Outreach and Advocacy It is concluded with some reflections on STISA Governance and Management.

Introduction

The introduction states the main objectives of the document, namely to outline a series of tasks that can be undertaken to help meet the overall mission of STISA-2024. It further provides a background understanding to both STISA-2024 and the work plan through a literature review. The review covers the evidence linking investment in science, technology and innovation to economic growth and development, which is the main rationale behind STISA-2024. The critical components of STISA-2024 are outlined, including its six priority areas and four pillars, together with its organisational architecture. This architecture covers a range decision making bodies and implementing bodies for STISA-2024 that have their origins within the African Union, the Regional Economic Communities (RECs), member states, the public sector, the private sector, academia and civil society across the five sub-regions of Africa. The alignment between STISA-2024 and the guiding strategy for Africa's development over the next 50 years, namely Agenda 2063, is also demonstrated.

The concept of innovation is defined and various approaches to its measurement are outlined, with particular reference to the African context. It is critically important to understand that the term 'innovation', as used in this work plan, reflects more than an idea or an invention; it incorporates implementation into use, for example through entry into the market. Innovation generates value and has value. The significance of collaborative partnership for creating innovation, notably collaboration between academia, industry, government and civil society is noted, together with some underlying theories of innovation. For innovation to flourish a strong trade and industry environment is required. The importance of linking STISA to trade and industrial development initiatives, for example the African Union led initiative to create a continental free trade area, is highlighted.

The scope of this STISA-2024 work plan document is outlined and several key reports are referenced that provide background information on AU-approved and

related STI objectives and targets for Africa. These reports informed many of the work plan targets.

Overarching Strategic Principles and Structure

Broad-based consultations, together with a review of literature, informed the development of this work plan. A number of common themes emerged from the consultations and these resulted in a set of overarching strategic principles to guide the work plan, namely: (i) data-driven processes; (ii) stakeholder consultative approach, especially engaging with RECs; (iii) a well-defined role for the AU and its agencies; (iv) improved coordination and cross-talk; (v) a science diplomacy approach; (vi) African ownership and African financing; and (vii) openness to criticism.

Work Stream 1: Strategy Development and Monitoring and Evaluation

The top-level requirements and timelines for the urgent production of a monitoring and evaluation framework and implementation plan for STISA-2024 are provided. The value of undertaking a strategic foresight analysis to 2063, aligned to Agenda 2063, involving expert input and inclusive consultation is presented. Such an analysis would inform future 10-year strategies and accompanying implementation plans, starting with the development of the next 10-year strategy, STISA-2034.

Work Stream 2. Policy and Institutional Interventions

This work stream recognises the complexity of the STISA organisational architecture and attempts to guide STISA at a top level, engaging with RECs, but without being overly prescriptive of activities at REC and member state level. A number of work stream targets are identified within three main groupings: (i) institutional interventions and their establishment related to STISA-2024 and AU documentation; (ii) institutional interventions linked to the six priority areas of STISA to promote a coherent multi-disciplinary network that can connect activities on the ground to top-level STISA governance and management; and (iii) continental partnerships through which STISA can reinforce science diplomacy, for example with the UN and the private sector.

Work Stream 3: Research and Innovation

This work stream covers the strategies, implementation mechanisms and activities that are needed to promote action on the ground at member state level. There is a need to foster and link, on the one hand, the growth of science, technology and associated research and development, and on the other hand, innovation, entrepreneurship and associated industrial growth and trade. Background is provided on activities already under way on the continent, including: African Development Bank and World Bank financing of Higher Education Science and Technology and Centres of Excellence; the development of The Alliance for Accelerating Excellence in Science in Africa (AESA); and the African Union Research Grants Programme. The growth of technology hubs and

start-up companies are also documented along with the growth of incentive prizes for entrepreneurship. Work stream targets are presented in line with the four pillars of STISA-2024, namely; (i) infrastructure development; (ii) building technical competencies; (iii) innovation and entrepreneurship; and (iv) enabling environment.

Work Stream 4: Promoting STI Investment

A number of Financing Tools for Science Technology and Innovation in Africa are discussed. These include: grants and donations; loans, either at a micro level to a company or at a macro level to a country through a development bank; and capital investment or equity stake in a company. A major STISA body responsible for providing input into a fundraising strategy for STI on the continent will be the Resource Mobilisation Committee of ASRIC. Work stream targets, working in close association with RECs, include: (i) the need for member states to achieve 1% of GDP expenditure on research and development; (ii) the establishment of a continental African Science Technology and Innovation Fund (ASTIF); and (iii) the development of an overarching continental STISA resource mobilisation strategy.

Work Stream 5: STI Communication, Outreach and Advocacy

This work stream reviews the communications objectives outlined in STISA-2024, namely: popularisation of STISA and STI on the continent; promotion and utilisation of scientific knowledge and STI-related information and data; and promotion of awards and prizes, such as the Kwame Nkrumah Awards for Scientific Excellence. The need, in general, to improve the level and quality of information provided by national, regional and continental public sector organisations on STI is noted. A major STISA body responsible for guiding communication strategy for STI on the continent will be the Communication, Outreach and Education Committee of ASRIC. Work stream targets include: (i) working with RECs to develop regional and national communication strategies; (ii) the development of existing and new continental prizes for STI and entrepreneurship; and (iii) the development of an overarching continental communication, outreach and advocacy strategy for STISA.

Reflections on STISA Governance and Management

This final section focuses on some aspects of the STISA architecture and how its governance and management might be improved. It draws attention to the need to clearly assign the lead agencies for each work plan task, with the responsibility to deliver on work stream targets. It also proposes expanding the role of a think tank of continental experts created to advise an African Union Committee of 10 Heads of State (AU-C10) on education, science, technology and innovation, to provide an overarching steering role for STISA. The successes of STISA to date are noted, as are the challenges that still remain.

1. Introduction

Objectives of the Document

1. This work plan covers the final five years, 2019-2024, of the 10-year Science, Technology and Innovation Strategy for Africa, STISA-2024 (AUC, 2014a). It seeks to outline a series of tasks that can be undertaken to help meet the overall mission of STISA-2024, namely to

   "Accelerate Africa's transition to an innovation-led, knowledge-based economy".

   The task of developing such a work plan has been hindered by the fact that no agreed implementation plan for the 10-year period 2014-2024 has yet been developed and no official set of specific targets, or indicators, for the success, or otherwise, of STISA-2024 has yet been developed.

2. The authors have therefore had to revert to the original STISA-2024 document and related documents, combined with consultations and attendance at several African Union meetings, to ensure consistency between this work plan and the perceived targets of STISA-2024. Indeed, one of the main recommendations of this document is that an implementation plan and a monitoring and evaluation framework establishing a set of indicators and targets needs to be developed rapidly, and not just for the period ending 2024. There is an urgent need to look ahead and undertake a Strategic Foresight to 2063. This could then guide future 10-year strategies and implementation plans so that STISA is fully aligned with the AU's long-term development strategy as outlined in Agenda 2063 (AUC, 2014b) and its associated implementation plan (AUC, 2015).

3. In outlining this five-year work plan, it has been important to define tasks and objectives that are realisable and, as much as possible, under the control of the African Union and its associated agencies and continental partners to support action at REC and member state level. This has led to an emphasis on tasks to be undertaken and led by the AUC, the UN and associated agencies.

4. At the end of the day it is the policies and implementation activities of the Regional Economic Communities and Member States that provide the foundation for STISA. These will determine the success or failure of STISA, and indeed Agenda 2063. While recognising the need for Regional Economic Communities and Member States to develop and implement plans that meet broad objectives associated with Science, Technology and Innovation and industrial development enunciated by STISA, it is not the role of this document to prescribe to Regional Economic Communities or Member States in detail what their local specific work plans and targets should be. The role of this document is to provide a framework and supportive infrastructure within which Regional Economic Communities and

their member countries can operate, develop and coordinate their own plans and objectives.

5. Finally, as with any work plan, if this work plan is to be realised then those engaged in its implementation must understand the basic theoretical and strategic underpinnings of the tasks to be undertaken. This document therefore introduces some basic concepts and definitions associated with innovation and in particular how it is measured. It also seeks to do more than provide a set of tasks to be accomplished to assist the delivery of STISA-2024. It seeks to provide background information, explanations and justifications for the tasks proposed. A summary of the work plan targets is gathered in the Appendix.

Link between GDP and STI

6. There is a strong correlation between economic productivity and technological innovation (Hall, 2011) (Fox & Elnasri, 2015) (OECD, 2015a) (UNESCO, 2015) (ECA, 2018).[2] A major indicator of innovation is R&D intensity, which is defined as the Gross Expenditure on Research and Development (GERD) as a percentage of Gross Domestic Product (GDP). A second indicator is the number of Researchers (as full-time equivalents) per 1 million inhabitants. When these indicators are mapped globally, we see a strong positive correlation between the size of both indicators and those countries with the highest GDP per capita, as illustrated in Figures 1.1 and 1.2 (UNESCO, 2017a) (UNESCO, 2017b).[3]

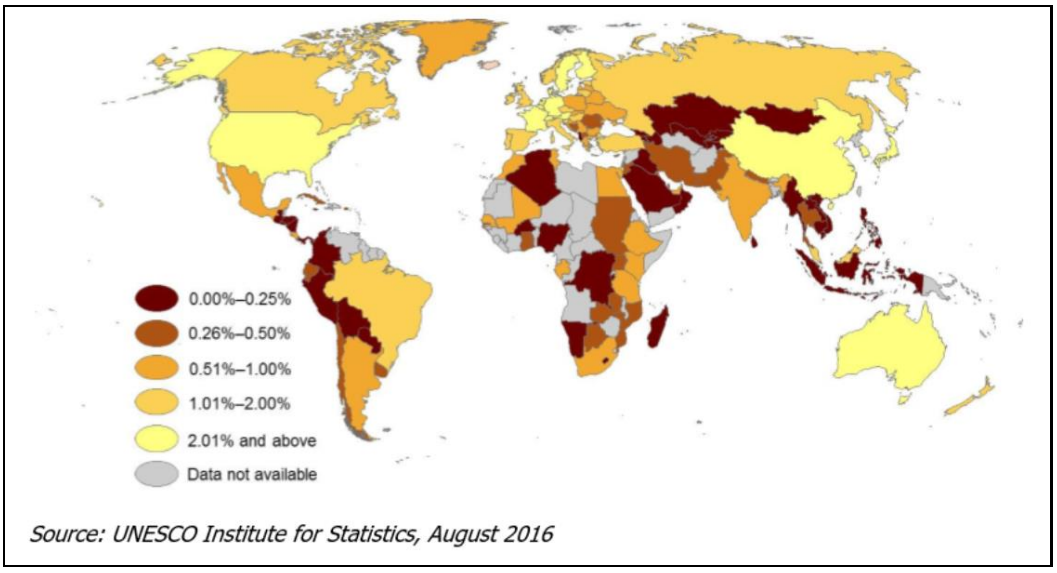

Figure 1.1 Global R&D Intensity (UNESCO, 2017a)

[2] See especially Chapter 2
[3] Data for references UNESCO 2017a and 2017b are accessible at: http://uis.unesco.org/en/news/rd-data-release

7. The top five R&D performing countries in terms of R&D expenditure as a proportion of GDP are: Israel (4.3%) and the Republic of Korea (4.2%), followed by Switzerland (3.4%), Sweden (3.3%) and Japan (3.1%). In absolute terms (in billion PPP[4] dollars), the top five countries are: United States (511 billion), China (452 billion), Japan (166 billion), Germany (119 billion) and the Republic of Republic of Korea (78 billion).

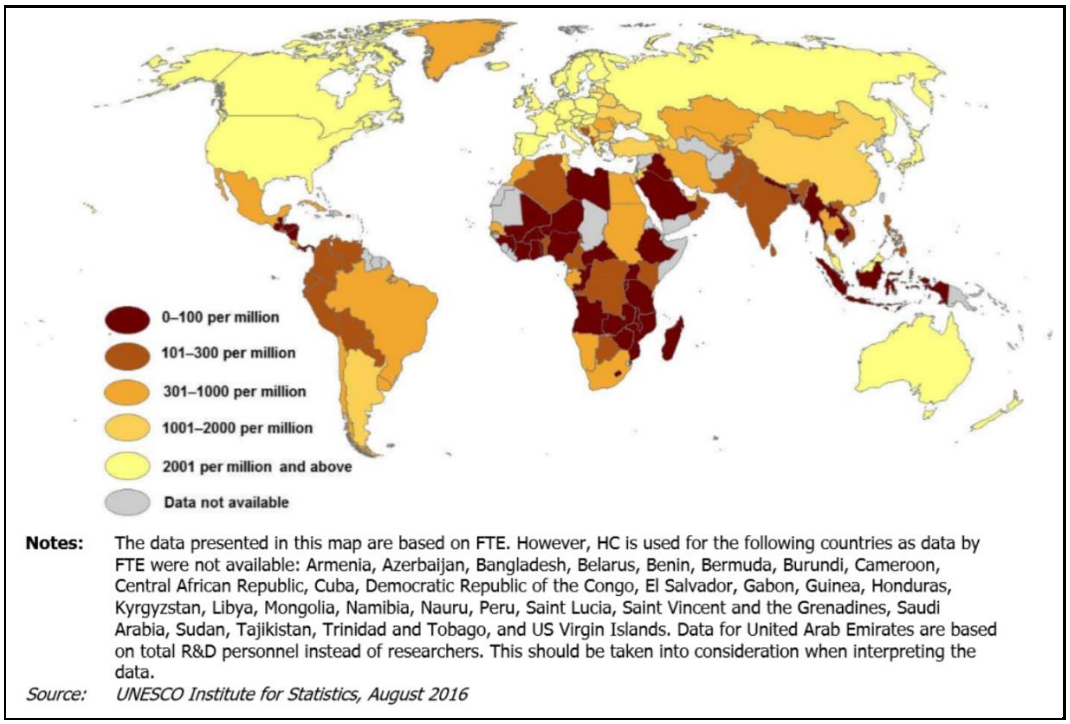

Figure 1.2. Researchers per million inhabitants (UNESCO, 2017b)

8. Because of this strong correlation between Research and Development and wealth, many countries and regional groupings set themselves targets for R&D expenditure. For example, the European Union seeks to raise overall R&D investment to 3%, though few countries have achieved that. By contrast, the USA spends 2.7% and China's research intensity has recently grown rapidly to over 2%. The African Union has set a target of 1% of GDP to be invested in R&D. Only three sub-Saharan African countries are close to this target: South Africa, Kenya and Senegal (around 0.8% in all three countries).

9. It should be recognised that the GERD figures cited for many of the less well developed sub-Saharan African countries may include a large proportion of R&D expenditure that comes from external (Rest of the World) agency funding. While welcome and important, such R&D expenditure may focus on areas that do not directly impact on domestic technological and industrial development. It may thus give a distorted view, and a perceived

[4] Definition of purchasing power parity (PPP) accessible at: https://en.wikipedia.org/wiki/Purchasing_power_parity

overestimate, of how much home-based government and business funded R&D is taking place in Africa.

10. Given the above background there has long been a desire within Africa to develop and enhance the continent's Science, Technology and Innovation capabilities to impact on economic growth and development, and there have been many African Union initiatives and Plans of Action over the years that have attempted to achieve this. The development and adoption by the African Union Heads of State of Agenda 2063 'The Africa we Want' (AUC, 2014b) provides an overarching aspiration for Africa's future and provides a potential framework within which STI can flourish. Within this context, a Science, Technology and Innovation Strategy for Africa, with the acronym STISA-2024 (AUC, 2014a) was developed and adopted by the AU General Assembly.

STISA-2024

11. The Mission of STISA-2024 is to

    "Accelerate Africa's transition to an innovation-led, Knowledge-based Economy".

    This will be achieved by:

    - Improving STI readiness in Africa in terms of infrastructure, professional and technical competence, and entrepreneurial capacity; and
    - Implementing specific policies and programs in science, technology and innovation that address societal needs in a holistic and sustainable way.

12. STISA-2024, the first of several planned 10-year strategies for Africa, is built upon a strategic orientation based upon six priority areas, namely: (i) eradication of hunger and achieving food security; (ii) prevention and control of diseases; (iii) communication (physical and intellectual mobility); (iv) protection of our space; (v) live together – build the society; and (vi) wealth creation. These are enunciated in Table 1.1.

Table 1.1. STISA-2024 Priority Areas (AUC, 2014a)

	Priorities	Research and/or innovation areas
1	**Eradicate Hunger and ensure Food and Nutrition Security**	- Agriculture/Agronomy in terms of cultivation technique, seeds, soil and climate - Industrial chain in terms of conservation and/or transformation and distribution infrastructure and techniques
2	**Prevent and Control Diseases and ensure Well-being**	- Better understanding of endemic diseases - HIV/AIDS, Malaria Hemoglobinopathie - Maternal and Child Health - Traditional Medicine
3	**Communication (Physical & Intellectual Mobility)**	- Physical communication in terms of land, air, river and maritime routes equipment and infrastructure and energy - Promoting local materials - Intellectual communications in terms of ICT
4	**Protect our Space**	- Environmental Protection including climate change studies - Biodiversity and Atmospheric Physics - Space technologies, maritime and sub-maritime exploration - Knowledge of the water cycle and river systems as well as river basin management
5	**Live Together – Build the Society**	- Citizenship, History and Shared values - Pan Africanism and Regional integration - Governance and Democracy, City Management, Mobility - Urban Hydrology and Hydraulics - Urban waste management
6	**Create Wealth**	- Education and Human Resource Development - Exploitation and management of mineral resources, forests, aquatics, marines etc - Management of water resources

13. STISA-2024 is further enunciated through five strategic objectives:
    - Enhance effectiveness of Science, Technology and Innovation (STI) in addressing/implementing priority areas.
    - Improve technical competencies and institutional capacity for STI development
    - Promote economic competitiveness through fostering innovation, value addition, industrial development and entrepreneurship in synergy with instruments such as the Action Plan for Accelerated Industrial Development of Africa (AIDA) and Pharmaceutical Manufacturing Plan for Africa (PMPA).
    - Protect knowledge production (including inventions, and indigenous knowledge) by strengthening Intellectual Property Rights (IPR) and regulatory regimes at all levels
    - Facilitate STI policy reforms, harmonization, science diplomacy and resource mobilisation

14. STISA-2024 anticipates the development of flagship programmes that may cut across the priority areas and generate research programmes that address the strategic objectives outlined in the previous paragraph.

15. However, STISA-2024 recognises the low capacity and the lack of readiness of the STI system in many countries as it operates across the continent. It therefore proposes certain implementation actions, or pillars,

upon which future STI activities can be better supported and implemented. The four pillars to be developed are:

- Infrastructure development, in the form of laboratories, ICT capabilities and National Research and Education Networks;
- Technical competences, such as through an expansion of postgraduate programmes and the development of postdoctoral career paths in STI, as well a popularising and promoting career paths through secondary school and TVET qualifications.
- Innovation and Entrepreneurship through the promotion of networking and collaboration between education and research and between private and public sectors, as well as promoting technology transfer, knowledge sharing and co-creation and adaptation of new products, services and processes;
- Enabling environment of policies and programmes that promote STI development, including appropriate legal and regulatory systems.

16. STISA-2024 includes an institutional architecture for its implementation (Figure 1.3). The stated institutional and implementation architecture for STISA-2024 is broadly divided into: (i) decision making structures and processes within the AU structure, supported by the AUC; and (ii) implementing structures and processes involving a variety of institutions, including AUDA-NEPAD; AfDB, RECs; Governments; Private sector; Specialised agencies and Development Partners.

17. The AU Assembly at the June/July 2018 AU Summit held in Nouakchott, Mauritania, approved the transition of NEPAD into a new body, the African Union Development Agency (AUDA-NEPAD)[5] and the development of a statute for AUDA-NEPAD for submission to the January 2019 summit. This development is part of a broader array of AU reforms[6] that include the push for the development of an African Continental Free Trade Area[7] (UNCTAD, 2016) (Afreximbank, 2018). These changes need to be taken into account as we proceed with the implementation of STISA.

[5] https://dev.au.int/en/nepad

[6] https://issafrica.org/iss-today/will-kagames-last-push-on-au-reform-bear-fruit

[7] https://au.int/en/ti/cfta/about

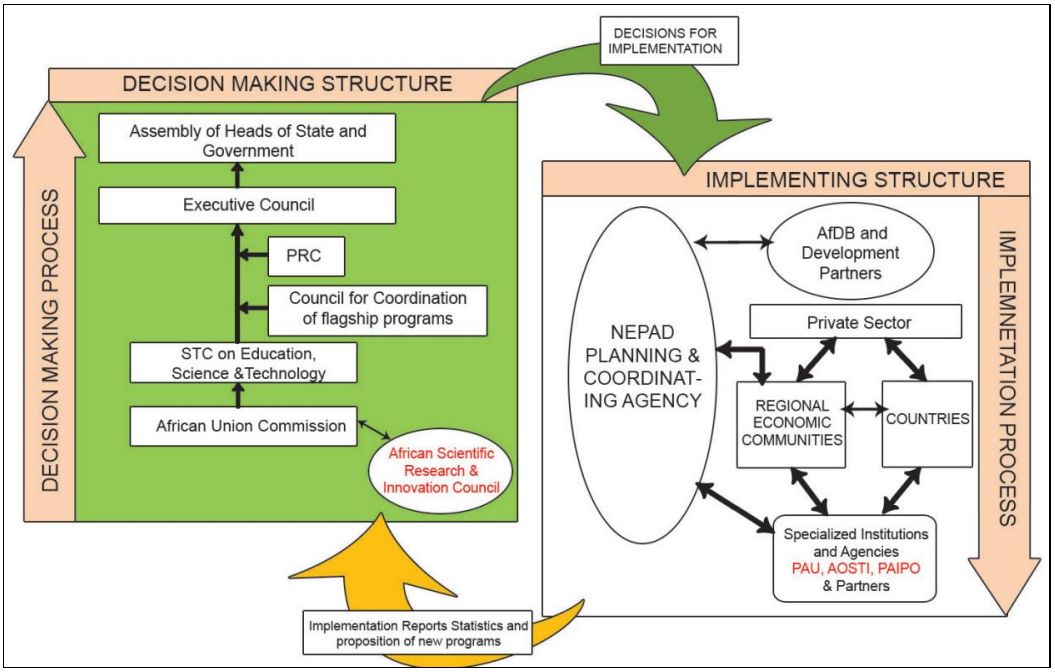

Figure 1.3. Institutional Architecture for STISA-2024 (AUC, 2014a)

18. A critical aspect of this infrastructure will be how best to ensure there is a strong synergy between Governments, Higher Education and Research Institutions, including TVET institutions, and the Business and Finance sectors. Strong and supportive interactions between these three institutional groupings will be critical for the delivery of innovation and its associated developmental impact.

Alignment of STISA-2024, Agenda 2063, SDGs and other AU strategies

19. Subsequent to the publication of Agenda 2063 and STISA-2024, the UN-based post-2015 development framework, taking over from the Millennium Development Goals (MDGs) namely the Sustainable Development Goals (SDGs) also known as Agenda 2030, was published under the motto 'Leave Nobody Behind' (UN, 2015).

20. STISA-2024 aligns especially to SDG 9, namely to

    "build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation"

    and all of its eight sub-elements. It is also closely aligned to SDG 4, namely to

    "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all",

    particularly as it relates to access to quality Higher Education, including Technical and Vocational Education and Training.

21. A document generated by the African Union leading up to the global SDGs that focused on an African perspective for SDG development is worth

referencing in this regard. Entitled the Africa Regional Report on the Sustainable Development Goals (ECA, AUC and AfDB, 2015) it provided some specific goals and targets, including a number directly related to Science Technology and Innovation. Some of these have been included in the current work plan.

22. STISA-2024 however, is first and foremost strongly linked to Agenda 2063. Indeed, a successful STISA is critical to the delivery of Agenda 2063 and continental achievement of the SDGs. Agenda 2063 is based on seven aspirations. The first two aspirations are predicated upon a technologically well developed and well-connected continental infrastructure and business and industrial environment. \they are::
    - Aspiration 1. *"A prosperous Africa based on inclusive growth and sustainable development."*
    - Aspiration 2. *"An integrated continent, politically united and based on the ideals of Pan-Africanism and the vision of Africa's Renaissance."*

23. Aspiration 1 includes the following relevant statements:
    - *"By 2063, African countries will be amongst the best performers in global quality of life measures. This will be attained through strategies for inclusive growth, job creation, increasing agricultural production; investments in science, technology, research and innovation; gender equality, youth empowerment and the provision of basic services including health, nutrition, education, shelter, water and sanitation."*
    - *"Africa's collective GDP will be proportionate to her share of the world's population and natural resource endowments."*

24. Aspiration 2 includes the following relevant statements
    - *"By 2063 the necessary infrastructure will be in place to support Africa's accelerated integration and growth, technological transformation, trade and development. This will include high-speed railway networks, roads, shipping lines, sea and air transport, as well as well-developed ICT and digital economy. A Pan African High-Speed Rail network will connect all the major cities/capitals of the continent, with adjacent highways and pipelines for gas, oil and water, as well as ICT Broadband cables and other infrastructure. This will be a catalyst for manufacturing, skills development, technology, research and development, integration and intra-African trade, investments and tourism."*
    - *"The world-class infrastructure accompanied by trade facilitation will see intra-African trade growing from less than 12% in 2013 to approaching 50% by 2045. African share of global trade shall rise from 2% to 12%. This will in turn spur*

the growth of Pan African companies of global reach in all sectors."

25. The linkage of STISA-2024 to Agenda 2063 is strongly recognised in the first 10-year implementation plan of Agenda 2063 (AUC, 2015). Achievement of Aspirations 1 and 2 of Agenda 2063 requires infrastructure and policies that support Innovation; Industrialisation; Entrepreneurship; and Trade; combined with environmental sustainability and equitable and inclusive engagement, most notably promoting gender equity (ECA, AUC and AfDB, 2016). A series of indicators and targets are provided within the Agenda 2063 first 10-year implementation plan that directly relate to STISA-2024 and these are reflected in this document.

26. STISA 2024 has a strong interface with two other AU strategies, namely the Continental Education Strategy for Africa 2016-2025, with the acronym CESA 16-25 (AUC, 2016a) and the Continental Strategy for Technical and Vocational Education and Training (TVET) (AUC, 2007). Particularly noteworthy interfaces occur with CESA 16-25 through its strategic objective 8 to

    "expand TVET opportunities at both secondary and tertiary levels and strengthen linkages between the world of work and education and training systems"

    and strategic objective 9 to

    "Revitalize and expand tertiary education, research and innovation to address continental challenges and promote global competitiveness."

27. A major approach to operationalise the linkages between STISA-2024 with CESA 16-25 and the TVET strategy is to promote common continental frameworks for qualifications that link the world of TVET and of Higher Education in general. These would promote intracontinental recognition of qualifications leading to enhanced intracontinental mobility. Bateman and Coles (2013) review the concept of Qualifications Frameworks, noting the rise of overarching regional frameworks. The most well-established regional framework operates under the European Association for Quality Assurance in Higher Education (ENQA)[8]. The ENQA is partnering with the AUC to develop a Pan-African Quality Assurance and Accreditation Framework (PAQAF)[9] (Okebukola, & Fonteyne, 2014).

28. STISA-2024 should be viewed as part of a continuum involving all three strategies, namely CESA 16-25, TVET strategy and STISA-2024. It is noteworthy that the recently convened First Extra-Ordinary Summit for The African Union Committee of Ten Heads of State and Government (AU-C10) Championing Education, Science, and Technology, held on 2nd–3rd

[8] https://enqa.eu/
[9] http://www.universityworldnews.com/article.php?story=20171117090752810

November 2018, Lilongwe, Malawi, covered all three of these strategic elements within their meeting remit.

STI Definitions and Measurement–OECD and Africa-Specific Approaches

29. If a country is to assess its performance in STI then it is critically important to have a data base, covering relevant indicators, by which such an assessment can be made. These databases are prevalent in most developed countries, many of which have integrated and coherent national economic and STI strategies. Their national decisions in STI are driven by STI assessment reports and national STI profiles, benchmarked against other countries. This knowledge base is lacking in most African countries, even as they seek to develop their national and sub-regional STI and related industrial strategies.

30. The OECD has for many years sought to develop guidelines and documentation that can assist their member countries to undertake such measurements, which in turn can lead to helpful reviews and analysis. Much of this OECD work is undertaken with inputs from UNESCO and the World Bank, which are also engaged in developing evidence bases to support decision making linked to innovation and socio-economic development.

31. Two important OECD documents in this regard are the Frascati Manual (OECD, 2015b) and the Oslo Manual (OECD, 2018a). The Frascati Manual focuses on data related to research and experimental development, while the Oslo Manual focuses on data related to innovation, primarily at the level of firms. Both are oriented such that their data can be linked to the UN System of National Accounts (UN, 2009).

32. Some useful definitions and descriptions of terms are provided in these documents. Innovation is defined within the context of economic development. The Oslo Manual notes that an innovation is more than a new idea or an invention. An innovation requires implementation. A business innovation is defined as:

> *"A new or improved product or business process (or combination thereof) that differs significantly from the firm's previous products or business processes and that has been introduced on the market or brought into use by the firm."*

33. Four dimensions of innovation guide its measurement: (i) Knowledge; (ii) Novelty; (iii) Implementation; and (iv) Value Creation. The latest edition of the Oslo Manual notes that innovation occurs across four sectors of an economy as per the UN System of National Accounting, namely: (i) Business Enterprise; (ii) General Government; (iii) Household; and (iv) Non-profit institutions serving households. It anticipates addressing innovation across all these areas in the future, but the latest edition of the Manual continues to focus on business innovation.

34. The Frascati Manual assesses the role of Research and Development within the Innovation Process. It categorises research and development as: (i) Basic research; (ii) Applied Research; and (iii) Experimental Development. It uses five criteria to define what is a R&D activity, namely it should be: (i) novel; (ii) creative; (iii) uncertain in its outcome; (iv) systematic; and (v) Transferable and/or reproducible. It defines five sectors within which it measures Gross Expenditure on R&D, namely: (i) Business Enterprise; (ii) Higher Education; (iii) Government; (iv) Private non-profit; and (v) Rest of the World, meaning funds received from outside the country for R&D.

35. The Frascati and Oslo Manuals have facilitated the collection of data from OECD countries, and increasingly from other countries, enhancing the potential for analysis. For example, the OECD produces a biennial STI Scoreboard (OECD, 2017) and a biennial Outlook (OECD, 2018b). It has also assisted the development of an STI strategy, which is regularly updated (OECD, 2015c).

36. The OECD assessments are quite complex, relying on a deep STI infrastructure within countries, and place a strong emphasis on surveys and sampling of the business sector. However, many developing countries have limited internal STI infrastructure and the informal and Government sectors often predominate. This has led some to use different approaches when seeking information on innovation for developing countries. One such attempt is the Global Innovation Index (Cornell University, INSEAD, and WIPO, 2018), supported by the World Intellectual Property Organisation. In South America the Bogota Manual (Jaramillo, Lugones, & Salazar, 2001) was produced to address these challenges. A Research Handbook on Innovation Governance for Emerging Economies is also available (Kuhlman & Ordonez-Matamoros, 2017). With respect to Africa, the capacity needs for STI policy making in Africa have been assessed (AOSTI, 2013) and recently, an Economic Commission for Africa commissioned study has led to a proposed framework for producing STI profiles for African countries (ECA, 2018). The next few paragraphs will describe in more detail the approach of the Global Innovation Index and the ECA study.

37. The Global Innovation Index produces an index based on an average score of five composite innovation inputs and an average score of two composite innovation outputs. The index score is the average of the innovation input score plus the innovation output score. The index places emphasis on measuring the climate and infrastructure for innovation and on assessing related outcomes, recognizing that innovation includes social innovations and business model innovations as well as technical innovation. The manual has the advantage that it gathers its data from existing data sources and does not require extensive additional surveys and sampling. It includes R&D measurement within its data points to assess innovation and captures data that can be assessed for high-income, middle-income and low-income countries. The five composite input elements and the two composite output elements each has three sub-composite elements and these are fed in turn

by a total of 80 indicator measurements. The seven major composite elements are:

Input elements

- **Institutions,** composed of: (i) Political Environment; (ii) Regulatory Environment; and (iii) Business Environment.
- **Human capital and research**, composed of: (i) Education; (ii) Tertiary Education; and (iii) Research and development (R&D).
- **Infrastructure,** composed of: (i) Information and communication technologies (ICTs); (ii) General Infrastructure; and (iii) Ecological sustainability.
- **Market sophistication,** composed of: (i) Credit; (ii) Investment; and (iii) Trade, competition and market scale.
- **Business sophistication**, composed of: (i) Knowledge workers; (ii) Innovation linkages; and (iii) Knowledge Absorption

Output elements

- **Knowledge and technology outputs,** composed of: (i) Knowledge creation; (ii) Knowledge impact; and (iii) Knowledge diffusion.
- **Creative outputs,** composed of: (i) Intangible assets; (ii) Creative goods and services; and (iii) Online Creativity

38. The ECA study proposed a framework that also combines innovation and R&D indicators within the one assessment. It contextualises the assessment against the backdrop of Agenda 2063 and STISA-2024. The data is obtained from a combination of both existing databases and specific surveys undertaken in countries. The study carried out country assessments in Nigeria and Kenya to validate the model and demonstrate the accessibility of the data required. It utilised readily obtainable input and output indicators across 4 pillars of country STI readiness, namely (i) STI actors' competences and capacity to innovate; (ii) STI actors' interactions; (iii) Human resources for innovation; and (iv) STI policy governance. This resulted in the following structure of country reports on STI readiness for Nigeria and Kenya.
    - Review of economic and innovation performance
    - Review of science, technology and innovation policies
    - STI actors' competences and capacity to innovate
    - STI actors' interactions
    - Human resources for innovation
    - STI policy governance
    - STI investment profiles and prospects

39. The African Union formally endorsed the Statute for the establishment of the African Observatory for Science, Technology and Innovation (AOSTI) in January 2016 (AUC, 2016b). AOSTI has the mandate, among others, to develop a framework for reviewing national innovation systems. In recent years AUDA-NEPAD, working with the African Science Technology Innovation Indicators (ASTII) initiative[10] has produced a 4-yearly African Innovation Outlook for the continent (NEPAD Planning and Coordinating Agency, 2014). With these organisations in place it is anticipated that coherent and relevant continental STI data will soon be available to assist policy makers and help drive STI instigated development across the continent.

Partnership and Innovation

40. Innovation is a complex, multi-factor endeavour and there are numerous theories that enable assessment and analysis of the processes involved. Given the multi-partnered approach required of STISA, it is appropriate to highlight several theories that relate to partnership and attempt to support certain types of interaction between different groupings in society. Three theories worth noting are: (i) Triple Helix Theory; (ii) Quadruple helix theory; and (iii) Open Innovation Theory.

41. The diffusion of knowledge and technology within society is a critical component of productivity and an effective innovation system. The three theories alluded to should therefore be seen against the backdrop of the necessity to promote the diffusion of knowledge and technology across society as a whole to improve overall productivity and to create an enabling environment for innovation (Andrews, Criscuolo, & Pilat, 2015) (OECD, 2015a)

42. The Triple Helix concept (Ranga & Etzkowitz, 2013) (Triple Helix Research Group, n.d.) was developed in the 1990s and stresses the importance of University–Industry–Government relationships in promoting innovation in a knowledge society. Previously, emphasis had been placed on Government-Industry relationships alone. This model is strongly linked to the concept of an Entrepreneurial University (Etzkowitz, 1983); (Etzkowitz, 2003) (Etzkowitz & Zhou, 2008) (Etzkowitz, Ranga, Guaranys, & Maculan, 2008)

43. The 'Quadruple Helix' concept adds the perspective of the citizens, the media-based and culture-based public and the users of innovation as a fourth component into the innovation system[11] (Carayannis & Campbell, 2009) (Höglund & Linton, 2017). It has been suggested that this model may be more relevant to less developed economies where there is a limited knowledge infrastructure (Kolehmainen, et al., 2016). This quadruple helix model and its extended range of civil society interactions has been linked to the concept of Open Innovation.

[10] http://www.nepad.org/programme/african-science-technology-and-innovation-indicators-astii
[11] https://toolkit.pe2020.eu/resource/triple-and-quadruple-helix/

44. Open Innovation is used to describe a process by which there is a freer exchange of information in the expectation of a mutual benefit for innovation. It is a process that runs counter to the traditional secrecy of corporate laboratories.[12] It was first defined more formally as

> *"the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively"* (Chesbrough H. , 2003) (Chesbrough & Bogers, 2014).

It has been aligned to both the Quadruple Helix[13] and the Triple Helix model. There has also been an attempt to assess its relevance, through the triple helix model, as a driver for innovation in emerging markets (Nel & Cook, 2016).

STI, Industrialisation and Trade

45. In order to fully realise the benefits of national innovation there is a need to access regional, continental and international markets. This requires a well-structured and organised industrialisation and trade framework. There is a need to boost intra-African Trade (Moyo, 2014). A recent study (Afreximbank, 2018) indicated that intra-African trade is low, at 15 percent of the total, illustrating that most African trade is directed to countries and economic groupings outside Africa rather than within Africa. By comparison, intra-regional trade for other areas are: Europe (67 percent), Asia (58 percent), North America (48 percent) and Latin America (20 percent).

46. Despite African countries' reliance on extra-African trade, only South Africa and Egypt have any extensive experience of WTO based trade negotiations.[14] Even within the current Regional Economic Communities there are substantive tariff and non-tariff barriers to trade, including visa restrictions on business travel. There are two major initiatives to promote free trade on the continent. The first is the agreement establishing a Tripartite Free Trade (TFTA) area among the Common Market for Eastern and Southern Africa (COMESA), the East African Community (EAC) and the Southern African Development Community (SADC).[15] The second which may potentially supersede the tripartite agreement, is the agreement to establish a Continental Free Trade Area (CFTA) across Africa.[16,17] These agreements will probably require several more years of negotiation before they are ready for implementation.

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[12] https://en.wikipedia.org/wiki/Open_innovation
[13] https://blog.innocentive.com/quadruple-helix-model-of-open-innovation
[14] COMESA Secretariat presentation at Malawi Tripartite Workshop, 5 - 6 October 2017, Lilongwe, Malawi
[15] https://www.tralac.org/news/article/7646-signed-agreement-establishing-a-tripartite-free-trade-area-among-comesa-the-eac-and-sadc.html
[16] https://au.int/en/treaties/agreement-establishing-african-continental-free-trade-area
[17] https://www.tralac.org/resources/by-region/cfta.html

47. Intra-African trade and industrialisation are crucial to the future inclusive prosperity of the continent as outlined in Agenda 2063. Science Technology and Innovation is a crucial driver of industrialisation, and hence trade. It is also a driver of value addition and diversification of exports, reducing the risk and vulnerability of countries being reliant on a small number of exportable products. As STISA develops there will need to be a close collaboration with Ministries of Trade and Industry and related organisations to promote the Innovation-Industrialisation-Trade interface.

48. The recent revival of the Pan-African Private Sector Trade and Investment Committee (PAFTRAC) by the African Union, in partnership with Afreximbank,[18,19] provides a potential interface for this dialogue. The secretariat will be hosted by Afreximbank. Membership of the Committee is drawn from leading private sector institutions and corporate entities across Africa, as well as from a range of continental and regional institutions, including: (i) Business organizations and traders with a significant continental footprint; (ii) Regional and sub-regional business associations and councils; (iii) Chambers of commerce; (iv) Industry associations; (v) Financial institutions; (vi) Professional, and policy research institutions; and (vii) Other relevant entities and strategic partners involved with trade and investment issues. PAFTRAC will therefore provide a framework to facilitate African Private Sector participation and engagement in trade and investment issues in Africa, including trade and investment policy formulation and trade negotiations in support of the sustainable development of African economies, in line with Agenda 2063. It is anticipated that PAFTRAC could serve as a stepping-stone toward the establishment of the African Business Council, which is envisaged under the African Continental Free Trade Agreement (CFTA) Architecture.

Scope of this Document and Challenges

49. This document seeks to put forward a top-level work plan that can assist STISA-2024's development over its final five years. While acknowledging the wide range of activities being undertaken by a range of different players within and outside the continent, its focus is on the architecture outlined in Figure 1.3 under the guidance of the African Union.

50. A major challenge in developing this work plan has been the lack of an official, defined set of indicators and targets, and the lack of an accompanying monitoring and evaluation framework and implementation plan to underpin STISA-2024 related operations to date. Thus, the document relies on stated and inferred goals and targets from:
    - STISA-2024 (AUC, 2014a);

[18] https://au.int/en/newsevents/20181019/pan-african-private-sector-trade-and-investment-committee-brief
[19] https://thebftonline.com/2018/world/africa/africa-gets-private-sector-trade-and-investment-committee/

- Agenda 2063 (AUC, 2014b) and its first 10-year implementation plan (AUC, 2015);
- African Union Goals and Targets suggested as relevant for the Sustainable Development Goals (ECA, AUC and AfDB, 2015);
- CESA 16-25 (AUC, 2016a);
- TVET Strategy (AUC, 2007);
- The Lilongwe Declaration approved by the First Extra-Ordinary Summit for the Committee of Ten Heads of State and Government (AU-C10) championing Education, Science and Technology (AUC, 2018a) and its associated Action Plan (AUC, 2018b);
- Policy Analysis on Science, Technology and Innovation Strategy for Africa 2024 by the AU Scientific Technical Research Commission (Hamdy, et al., 2016) ;
- Information from the First Congress of the African Scientific Research and Innovation Council (ASRIC) held in Abuja, Nigeria, 27th–29th November, 2018; and
- other documents as referenced.

51. It is anticipated that this work plan will facilitate the development of a formal monitoring and evaluation framework and implementation plan for STISA-2024 and that it will lead to the development of a Strategic Foresight analysis looking ahead to 2063, aligned to Agenda 2063. This in turn, would facilitate the subsequent development of a strategy, work plan and monitoring and evaluation framework for the next 10-year strategy, namely STISA-2034.

Overarching Strategic Principles and Work Plan Structure

52. Consultations were undertaken with a wide range of individuals with experiences of Science, Technology and Innovation within a continental, sub-regional and national context. A number of common themes emerged from these consultations. These resulted in a set of overarching strategic principles that guide the work plan. Interestingly, many of the issues raised are reflected in the recommendations for the institutional reform of the African Union (Kagame, 2017) (AUC, 2018c). This section first documents the thematic issues raised during the consultation and then presents the resultant principles.

Common Themes Emerging from Consultations

53. **Complexity of STISA.** There is a major challenge for STISA. How do we develop a continental-wide, cross-cutting strategy such as STISA, so that it bridges the high-level, diplomatic process-driven policy discussions that occur at African Union level, with the fluid and dynamic action-oriented ground-level activities, that are crucial to operational success? This issue is further complicated by the fact that what starts out as a public sector-oriented set of activities must ultimately transition to the private sector to

realise the full economic and developmental benefits of the strategy. An innovation requires implementation and, to be counted as a success, this implementation normally requires expanded access and application within the market place, with the consequent generation of wealth. Many of the themes raised in the consultation respond to this challenge.

54. **STISA is Essential for Agenda 2063**. It was widely recognised that STISA is an essential component of Agenda 2063 and that Science, Technology and Innovation are critical for future African development. The vast majority of countries and Regional Economic Communities have developed, or are developing, their own STI agendas and strategies, with varying reference to STISA. There has been a general increase in STI related activities on the continent over the past several years. A lot of this activity is happening in the name of STISA-2024. A lot of activity is also happening independent of STISA-2024.

55. **M&E Framework and and Implementation Plan. The Need for Data.** There is an urgent need to develop and finalise a monitoring and evaluation framework for STISA-2024 and an accompanying implementation plan. Despite the recognition of STISA's importance, these do not yet exist and without clear indicators and targets STISA-2024 lacks overall direction. In the words of one respondent

    "The [STISA] document is fine. It is the implementation that is missing."

    An overall implementation plan would be especially useful to the less well-developed countries and regional groupings on the continent that are in need of guidance in this highly technical area. An implementation plan would also provide a platform for data acquisition and accumulation on STI in Africa and so improve continental, regional and national planning. STISA needs to be data-driven.

56. **Stakeholder Consultation.** There is a need to for more substantive consultation with stakeholders if there is to be a continental ownership of STISA and its related continental activities. Most notably, individuals associated with Regional Economic Communities felt that they, and countries, were bypassed, or latecomers, to AU policy documentation relating to STISA-2024. There was a desire for the AUC to engage early with RECs for future strategy formulation and not just to bring them

    "the cake as it is about to be shared."

    The policy documents, such as STISA-2024, are approved at the AU General Assembly because they are important areas of activity, but the documents are not necessarily fully owned by those countries approving them.

57. **Recognise the Key Players on the Ground.** There should be an increased recognition of non-AU institutions and partners in STISA. The language of STISA is AU-centric. The institutions and individuals who will ultimately

create innovations, and deliver the products and services that derive from innovations, predominantly operate outside the African Union, REC, national government and public sector. The AU-based organisational structure outlined in Figure 1.3 must recognise this and respond accordingly. The role of this AU-based architecture should be to facilitate and help drive innovation, not to take on full responsibility for its generation, delivery and implementation.

58. **Role of AUC Institutions.** The AUC and related agencies, notably AUDA-NEPAD, need to keep to their mandates and guiding principles. For example, the mission of the AUC is to be:

> *"An efficient and value-adding institution driving the African integration and development process in close collaboration with African Union Member States, the Regional Economic Communities and African citizens"*

The guiding principles[20] of the AUC in general are:

- Subsidiarity and complementarity with other Organs, Member States and RECs;
- Results orientation, feasibility and impact focus;
- Close coordination and cooperation with the RECs
- Coherence of policies and programmes; and
- A networking approach that takes advantage of available resources through other players.

The mandate of AUDA-NEPAD[21] is:

i. To coordinate and execute priority regional and continental projects to promote regional integration towards the accelerated realisation of Agenda 2063;
ii. To strengthen capacity of African Union Member States and regional bodies;
    - advance knowledge-based advisory support,
    - undertake the full range of resource mobilisation, and
    - serve as the continent's technical interface with all Africa's development stakeholders and development partners;:

59. **Definition of Roles.** We need to define what is meant by 'Implementing Structure' in figure 1.3. Some of the agencies mentioned 'implement' and deliver on innovation at the ground level e.g. Private Sector Firms, Universities. Others primarily provide a bridge from the aspirations of 'top-level' African Union Decision Making Bodies to the institutions and individuals undertaking the innovation. RECs and National Governments do not 'implement' innovation. They provide, and to a large extent finance, the framework at sub-regional and national level that can promote and stimulate innovation. It is important that there is a clear understanding of the

[20] https://au.int/en/commission
[21] https://www.nepad.org/publication/auda-nepad-mandate

respective roles that the different institutions play in this highly complex matrix. A better terminology than 'Implementing Structure' in Figure 1.3 might be 'Translational Structure'. The agencies highlighted under this grouping will be responsible for translating the aspirational policies and decisions of the AU bodies at continental level into policies, decisions and operational frameworks that will promote innovation 'on the ground', whether this be national, sub-regional or continental in scope.

60. **Coordination.** There needs to be better coordination and cross-talk between the 'governance' agencies involved in this process. This is strongly linked to the calls for more inclusive consultation and the need to more clearly define agency roles, as already outlined above. Several respondents referred to a 'silo' mentality where there is a degree of internal competition between the governing bodies outlined in Figure 1.3 and in some cases, competition for funds between these agencies and the institutions on the ground that they are supposed to be supporting.

61. **Government, Industry, University, Society Partnership.** There was a strong call for improved links between the Public Sector and the Private Sector at continental, regional and national levels. In particular, there is a need to create Government-Industry-University linkages to promote innovation (triple helix approach) with civil society also involved as appropriate (quadruple helix approach).

62. **Science Diplomacy.** There was a call for Science diplomacy[22,23] (Gluckman, Turekian, Grimes, & Kishi, 2017) to be incorporated within STISA. This term is widely accepted to cover three main areas: (i) 'Science in diplomacy' where Science can provide advice to inform and support foreign policy objectives; (ii) 'Diplomacy for science' where Diplomacy can facilitate international scientific cooperation; and (iii) Science for diplomacy where Scientific cooperation can improve international relations. The UN, e.g. through UNESCO, ECA and others, can be partners to the AU in this role. Such coordinated, scientific action across borders can also promote continental integration.

63. **African Ownership and Financing.** There were frequent calls for the STISA process to be African owned and financed in line with recent AU reforms (AUC, n.d.). Many of the major initiatives under way on the continent are almost completely development partner funded. Examples cited include: the Alliance for Accelerating Excellence in Science in Africa (AESA)[24] and the AU Kwame Nkrumah Awards for Scientific Excellence.[25]

[22] https://twas.org/science-diplomacy
[23] http://www.unesco.org/new/en/natural-sciences/science-technology/science-policy-and-society/science-diplomacy/
[24] https://aesa.ac.ke/
[25] https://au.int/en/announcements/20180611/african-union-kwame-nkrumah-awards-scientific-excellence-auknase-continental

The support from Development Partners is very much appreciated, especially when they follow African strategic priorities and best practice (European Union, 2014) but there is a desire that African Governments and institutions should also visibly contribute resources to such ventures and thus ensure a higher degree of African ownership and strategic direction. An example of such a move to transition from development partner funding to member state funding has occurred with the African Science, Technology and Innovation Indicators (ASTII) initiative[26] (AUDA-NEPAD, personal communication). More resources to fund STI in Africa need to come from within Africa.

64. **Adequate Funding of AU bodies.** Many of the organisations established to run the STI agenda, including the AUC based HRST department, are short-staffed, with limited budgets, and this may be one of the reasons why some critical items of the STISA agenda, including the establishment of M&E systems and the development of an implementation plan have not been carried out. There is a need to effectively fund the AUC and its associated bodies, notably AUDA-NEPAD, if they are to deliver on their commitments.

65. **Promote Cutting Edge Science and Technology.** Science and Technology research is a major driver of innovation and has provided the underpinnings of much of societal development over the recent centuries. The continent of Africa has a lot of catching up to do with respect to its infrastructure and skilled manpower and technical competence to be able to compete globally. However, as we progress, we should recognise that as we 'catch up' we also need to become leaders in critical areas. Scientific leadership in critical areas and true scientific discovery and technical innovation will yield rewards and competitively attract resources that enable development, reducing and complementing the need for developmental assistance. The initiative by AUC-HRST and AUDA-NEPAD to appoint a high-level panel on emerging technologies (APET)[27] is a useful move in this regard to stimulate a broad understanding of the potential to develop cutting edge technologies in Africa. At a higher political level, the development of an African Space Policy (AUC, 2016c) is another significant move in this direction.

66. **Science &Technology Research is not the whole solution**. As we promote R&D in Science and Technology, we must recognise that to achieve innovation there is a need to invest in, and undertake research in, a range of other disciplines. Thus, vocational training in subjects such as management, business, law and finance is also critical. The humanities, which provide an understanding of human nature and society at large are also critical to the establishment and implementation of an innovation

[26] http://www.nepad.org/programme/african-science-technology-and-innovation-indicators-astii
[27] https://www.nepad.org/news/reports-emerging-technologies-officially-launched-africa-innovation-summit

system. It is important not to over-compartmentalise activities. It is worth noting that the six priority areas and the four cross-cutting pillars of STISA each require a range of expertise over and above scientists and technologists. STISA covers a wide range of multi-sectoral activities, requiring multi-disciplinary and multi-partner approaches.

67. **Linking STI to Trade and Industry.** STI stimulates industrialisation and trade. A strong and well-regulated free trading system stimulates industrialisation and associated innovation, with appropriate quality standards for products. As the continent moves to enhanced intra-African trade under negotiated free trade agreements, there will need to be an enhanced interface between the policy makers and governance structures of STI and the policy makers and governance structures of trade and industry. Countries will also have to develop capacities to engage in trade negotiations and, even within local trading blocks, to domesticate appropriate international regulations, legal frameworks and agreements (COMESA, 2016).

68. **Begin Preparation Now for STISA-2034 and beyond**. The AU needs to already be looking beyond the end of STISA-2024 and begin consultations now for its successors, STISA-2034 and beyond. There is a need to undertake strategic STI foresight analysis for the long-term leading up to the end of Agenda 2063. Future strategies should involve more early and broad-based consultation. They should be informed by a bottom-up approach as well as a top-down approach (Fullan, 1994). Scenario planning and strategic foresight analysis can ensure a thorough and informed strategy. Future strategies should contain implementation plans and monitoring and evaluation frameworks as they are developed. Future strategies should be formally approved along with their accompanying implementation plans and monitoring and evaluation frameworks .

69. **Utilise the AU-C10 Think Tank to also Advise on STISA.** The First Extra-Ordinary Summit for The Committee of Ten Heads of State and Government (AU-C10) Championing Education, Science, and Technology, held on 2nd–3rd November 2018, Lilongwe, Malawi, decided to create a 'Think Tank' to support the work of the AU-C10. Such a group of eminent individuals, perhaps consisting of African and Diaspora scientists, technologists, industrialists, entrepreneurs and financiers, could also usefully also advise on STISA more broadly. It would be important that such a group has a strong interface with the APET high-level panel on emerging technologies.

Strategic Principles to Support 5-Year Work Plan

70. Based on the above themes that emerged from consultations a range of strategic principles have been developed to underpin the work plan of STISA. These are outlined below.

71. **Data-Driven Processes.** The development of a Monitoring and Evaluation Framework and the capturing of data from countries and elsewhere to assess progress with STISA is an essential component of STISA-2024, future versions of STISA, and other STI related activities on the continent. There is a saying that ‘What gets measured gets done.’

72. **Ongoing Stakeholder Consultative Approach.** The development of implementation planning and future STISA development requires broad consultation, including at REC level, with a broad range of partners. It requires a combination of bottom-up and top-down approaches.

73. **The AU and its agencies should have clearly defined roles within STISA.** The STISA architecture is complex and there is a danger that roles and responsibilities of AU agencies can become confused and overlap, both with each other and those of partner organizations. This can be addressed by having a clear ‘lead’ agency with responsibility for coordinating specific activities and achieving associated targets. This should be combined with broad stakeholder and partner consultation and communication so that partner roles and objectives are well understood.

74. **Improved coordination and cross-talk**. This needs to take place at several levels:
    i. Between AUC and AU Specialised Agencies, notably AUDA-NEPAD.
    ii. Between AU and its partners, notably the UN and its Specialised Agencies, which have similar mandates
    iii. Between AU Continental level bodies and AU Regional and National level bodies and their specialised agencies
    iv. Between all the organisations identified in Figure 1.3,
    v. Between numerous substantive organisations active within the six priority areas of STISA, both intra-sectoral within each of the six priority areas, and extra-sectoral between the six areas so that the cross-cutting nature of STISA can be appreciated and reinforced.
    vi. Between Public Sector (AU, RECs and Governments), the private sector and universities, as outlined with the ‘triple helix model of innovation
    vii. Between Public Sector (AU, RECs and Governments), the private sector, universities and civil society as outlined with the ‘quadruple helix model of innovation.
    viii. Between Government Ministries and Departments responsible for Science Technology and Innovation and other Ministries and Departments, notably of Trade and Industry.
    ix. Between AU and major financial institutions, especially within Africa.

75. **Science Diplomacy Approach.** Recognise the power and leverage potential of the AU and its specialised agencies with partners, including development partners and the private sector, and include working with the UN where appropriate.

76. **African ownership and African financing.** In line with the AU Reforms on Sustainable Financing,[28] a major effort should be undertaken to ensure substantive funding of STISA comes from within Africa, including from Governments. This should include adequate resources for the secretariat of the AUC and its specialised agencies.

77. **Openness to Criticism.** Building in a system constructive criticism to the STISA process, obtained through stakeholder consultation and the AU-C10 Think Tank, will ultimately strengthen and improve STISA implementation

Structure of Work Plan

78. This work plan is primarily driven by what is stipulated in STISA-2024 and related documents, such as those listed in section 1.8. However, it is informed by the general literature on STI, such as that provided in the introduction, and from consultations. The work plan is divided into 5 work streams, with a concluding section on STISA Governance and Management.

79. Work Stream 1, on Strategy Development and Monitoring and Evaluation, seeks to provide a framework within which STISA can be more easily understood and promoted through the acquisition of data. This data can then inform policy and action. This section has been prioritised because of the current lack of a STISA-2024 implementation plan or monitoring and evaluation framework. The work stream examines the need to think ahead not just to the end of STISA-2024, but to develop strategic foresight analysis looking ahead to 2063, in alignment with Agenda 2063, and thus assist the development of the next 10-year strategy, namely STISA-2034.

80. Work Stream 2 on Policy and Institutional Interventions focuses on establishing the top level institutional and policy architecture required for STISA 2024 to become fully operational. Although we are halfway through the time scale of STISA-2024, several key components of the anticipated architecture are either not yet in place (PAIPO, ASTIF) or only very recently established (ASRIC). Several key activities (Flagship programmes) are not yet initiated. This Work Stream therefore seeks to ensure that the appropriate architecture and associated tools are put in place to ensure the future development of STISA. At the very least, these elements need to be in place and fully operational by the end of STISA-2024 so that STISA-2034,

[28] https://au.int/en/AUReforms/areas/financing

and beyond to STISA-2063, has all the necessary support structures in place for success. The work stream addresses policy and institutional interventions in three components: (i) institutions listed as part of the STISA-2024 institutional architecture; (ii) institutions engaged in the six priority areas of STISA-2024; and (iii) broader continental institutional partnerships, especially with the UN and the business sector.

81. Work Stream 3 on Research and Innovation covers the strategies and implementation mechanisms that are needed to support the growth of STI and industry on the ground at country level. This section recognises, and seeks to support, the work that is being done by many individuals and organisations, for example in academia through research, and in the private sector promoting businesses and entrepreneurship. The actions are categorised under the four pillars of STISA, namely (i) Infrastructure Development; (ii) Technical Competences; (iii) Innovation & Entrepreneurship; and (iv) Enabling Environment.

82. Work Stream 4, on promoting STI Investment, seeks to identify approaches to substantively increase resources for Research, Innovation and Entrepreneurship on the continent. It notes some ongoing initiatives to increase such funding and the need to achieve some existing policies and targets, such as the target to spend 1% of GDP on Research and Development, which if implemented, would have a major positive impact. It notes the need to establish an African STI Fund (ASTIF). It also highlights the need to establish an overarching continental Resource Mobilisation strategy for STI across the continent and notes in this regard the activities of the ASRIC Resource Mobilisation Committee.

83. Work Stream 5, on STI Communication, Outreach and Advocacy covers how the objectives of STISA might be better communicated, and how activities and opportunities on the ground can be better reported, to help promote communities of STI actors to connect and interact. It includes the need for coherent continental, regional and national communications strategies; the expansion and development of STI prizes and notes in this regard the activities of the ASRIC Communications, Outreach and Education Committee.

84. A final section provides some reflections on STISA Governance and Management and how this might be improved.

85. Given the lack of a Monitoring and Evaluation Framework for STISA, work plan activities and targets were taken directly from STISA-related literature and supplemented by other documentation as listed in Section 1.8.

1.1.1.1

2. Work Stream 1: Strategy Development and Monitoring and Evaluation

Background

2.1.1. Monitoring and Evaluation Framework and Implementation Plan

86. The measurement of innovation and its monitoring and evaluation were covered in section 1.5. The urgent need for a monitoring and evaluation framework and implementation plan for STISA informs this work stream. Effective monitoring and evaluation will impact on the delivery of STISA in the long run, looking forward to 2024, 2034, 2063 and beyond. There is a saying: 'what gets measured gets done.' We need to be able to measure performance against expectations to plan for the future. We need to know what data to collect so that we can measure that performance. None of this can happen without an effective monitoring and evaluation framework and an implementation plan with defined targets.

87. One of the reasons why STISA-2024 still lacks a monitoring and evaluation framework and implementation plan could be that the assignment of responsibility for the ownership and production of these documents is unclear. Both AOSTI and AUDA-NEPAD, which houses the African Science and Technology Innovation Indicators (ASTII) initiative and produces the African Innovation Outlook series, have a role to play. However, for whatever reason, early preparatory work to deliver a monitoring and evaluation framework and implementation plan was not taken to completion. It may be that other statistical organisations could provide support for this endeavour, for example the UNESCO Institute for Statistics and the Statistical Commission for Africa (StatCom-Africa) which is the apex inter-governmental body on statistical capacity development in Africa.[29] Ultimately it would be beneficial for core STI statistics to be included within the African Statistical Yearbook (ECA, AfDB and AUC, 2018) to help advance the cause of STISA.

2.1.2. Forward Planning and Strategic Foresight Analysis

88. The consultations with key stakeholders, especially the RECs, indicated that there had been insufficient consultation with RECs and member states in drawing up STISA-2024. The consultations also suggested that it might be more appropriate to look to strategic foresight analysis (Van de Pol, 2017) for a long-term STI strategy, aligning with Agenda 2063. Since the launch of STISA-2024, many RECs and member states have drawn up new or revised Strategies for Science Technology and Innovation, or their

[29] https://www.uneca.org/acs/pages/our-focus

equivalents. There is therefore an increased appreciation of such strategies and the roles such strategies can play in long term economic planning. A strategically significant component of this work stream will be to initiate a strategic foresight analysis for STISA-2063, with appropriate broad consultation. This can then be used as a platform for the development of the next 10-year plan, STISA-2034, together with a purpose-designed 10-year monitoring and evaluation framework and implementation plan.

89. The monitoring and evaluation framework and implementation plan developed for STISA-2024, combined with this work plan, may be utilised for the end of term review and closing evaluation of STISA-2024. The Global Innovation Index may be utilised for an annual assessment of STI on the continent in the interim and may contribute to the monitoring and evaluation framework. The 'African Innovation Outlook' document produced by AUDA-NEPAD every four years could ultimately be utilised as the official report on STISA and STI-related activities on the continent. Once a strong monitoring and evaluation framework and implementation plan is put in place then it may be appropriate for the 'African Innovation Outlook' to be produced at an increased frequency, perhaps biennially or annually.

90. What is needed most of all is an expansion of STISA-related activities and an increase in the proportion of the African population that is engaged in STISA-related activities. This will give rise to innovation output and associated economic growth. The monitoring and evaluation framework must, at its most basic, capture the outputs, outcomes and impact of this activity for the people of Africa.

2.1.3. Structure of Work Stream 1

91. The work stream is composed of three main elements: (i) STISA-2024 M&E framework and implementation plan; (ii) Foresight Analysis and future STISA 10-year plans; and (iii) End of Programme Review of STISA-2024.

Work Stream Action

2.1.4. STISA-2024 M&E Framework and Implementation Plan

92. The lack of a monitoring and evaluation framework and the lack of an implementation plan, has limited the impact of STISA-2024 to date. Their preparation is a top priority.

Target	Timeline	Lead	Partners
STISA-2024 M&E framework and implementation plan			

M&E Framework • Approved gender-responsive STISA-2024 M&E Framework with relevant indicators that has been generated with involvement of key stakeholders, notably RECS, seeking alignment with regional and national frameworks. • A harmonised mechanism, supported by AOSTI, ASRIC and AUDA-NEPAD that will support Member States and RECs to collect standardised data.	Dec 2019 Ongoing	AOSTI AOSTI	RECS, Member States, UN, AUC-HRST, AUDA-NEPAD, ASRIC, AOSTI, AfDB, Private Sector, Academia. Professional bodies e.g. Engineers, Civil Society
Implementation Plan • Approved gender-responsive STISA-2024 implementation plan, using indicators from M&E Framework that has been generated with involvement of key stakeholders, notably RECS, seeking alignment with regional and national plans. • Annual progress reports on implementation plan with audited revision of targets and / or timelines as necessary, based on data acquisition.	Dec 2019 Ongoing	AUDA-NEPAD AUDA-NEPAD	
Link to Africa Innovation Outlook • Data driven by the M&E framework to inform Africa Innovation Outlook 2022.	Dec 2021	AUDA-NEPAD	

2.1.5. Foresight and Future STISA 10-year plans

93. There is a need to initiate a STISA foresight and strategy development exercise looking ahead to 2063 to align with Agenda 2063 and to be internally consistent with the Sustainable Development Goals (Agenda 2030). The document could be entitled STISA Foresight 2063. This exercise must be highly consultative with REC, member state and broad public sector, private sector, academic sector and civil society stakeholder engagement. Its outputs should include top-level direction for intermediate 10-year strategies leading up to 2063 and in this way feed into STISA-2034. The Foresight analysis should also incorporate a detailed assessment of the STISA institutional architecture, and, if necessary, incorporate a revision of that architecture and how STISA is governed and managed. This may be particularly relevant given the internal changes being implemented within the African Union. Finally, it should seek to establish some top-level targets and indicators for Science, Technology and Innovation in Africa, for example along the lines of Agenda 2063, the Millennium Development Goals and Sustainable Development Goals. Such Goals have galvanised the international community for the MDGs and the SDGs. At a more

moderate level, an appropriate set of realisable top-level goals could have the same impact for STISA.

Target	Timeline	Lead	Partners
STISA 2063 Strategic Foresight • Approved Strategic Foresight (STISA Foresight 2063) aligned to Agenda 2063, undertaken through a consultative process involving experts and key stakeholders, including RECS, that includes top-level direction for intermediate 10-year strategies leading up to 2063. o Intermediate Target of Initiation	Jun 2022 Jun 2019	AUC-HRST	RECS, Member States, UN, AUC-HRST, AUDA-NEPAD, ASRIC, AOSTI, AfDB, Private Sector, Academia. Professional bodies e.g. Engineers, Civil Society
STISA-2034 with M&E framework and implementation plan			
Strategy • Approved gender-responsive STISA-2034 Strategy undertaken through a consultative process involving experts and key stakeholders, including RECS, seeking alignment with regional and national strategies. o Intermediate Target of Initiation	Jun 2024 Jun 2022	AUC-HRST	
M&E Framework • Approved gender-responsive STISA-2034 M&E framework undertaken through a consultative process involving experts and key stakeholders, including RECS, seeking alignment with regional and national frameworks. o Intermediate Target of Initiation	Jun 2024 Jun 2022	AOSTI	
Implementation Plan • Approved gender-responsive STISA-2034 implementation plan, undertaken through a consultative process involving experts and key stakeholders, including RECS, seeking alignment with regional and national plans, and that incorporates plans for a mid-term review.:	Jun 2024	AUDA-NEPAD	

○ Intermediate Target of Initiation	Jun 2022		

2.1.6. End of Programme Review of STISA-2024

94. Three is a need to prepare for a comprehensive end of programme review of STISA-2024. This should be based on the comprehensive set of comparative indicators developed within the M&E framework and implementation plan, combined with a comprehensive set of reports to inform the review. The reports could, for example, include separate reports for each Priority Area of STISA. The review could also be informed by Innovation Outlook 2022. If the End of Programme Review was developed in tandem with the STISA-2034 strategy development these two processes could reinforce each other. Thus, the main lessons from the report, combined with the Foresight analysis, could inform STISA-2034.

Target	Timeline	Lead	Partners
STISA-2024 End of Term Review • Approved End of Term STISA-2024 Review Report undertaken through a consultative process involving experts and key stakeholders, including RECS, and to take into account African Innovation Outlook 2022. ○ Intermediate Target of Initiation	Jun 2024 Jun 2022	AUC-HRST	RECS, Member States, UN, AUDA-NEPAD, ASRIC, AOSTI, AfDB, Private Sector, Academia. Professional bodies e.g. Engineers, Civil Society

3. Work Stream 2: Policy and Institutional Intervention

Background

3.1.1. Complexity of STISA Architecture

95. The policy and institutional architecture of STISA-2024 is necessarily complex to accommodate the cross-cutting nature of STISA, which cuts across traditional sectoral boundaries. STISA's success will come from STI being effectively mainstreamed within these multiple sectors, rather than STI necessarily always being highlighted in its own right.

96. The complexity of the institutional Architecture of STISA-2024 is illustrated in Figure 1.3, listing 5 (five) decision making institutions operating as a part of the AU, and 12 (twelve) implementing organisations, or groups of related implementing organisations. These groups of organisations include diverse groupings such as: Member States; Regional Economic Communities; Development Partners; and Regional and International Research Institutions. They further include the entire STI-related Private Sector. Clearly organising activities that attempt to leverage results from such a broad array of actors is not straightforward.

97. Beyond this complexity there are numerous independent initiatives in place, some operating in partnership with the AU and its specialised agencies, and many operating independently of them. For example, a study to map and assess innovative initiatives in Higher Education in Africa (Kiamba, 2016) identified 30 (thirty) continental initiatives, 3 (three) regional initiatives and 16 (sixteen) national initiatives.

98. Given the complexity of this architecture, this work plan is, by definition, a top-level work plan. It will require further detailed development by those responsible for overseeing and reporting on STISA's implementation. In particular, it will require further detailed work at REC and country level. This work plan attempts to generate activities and objectives that can generically engage, assist, support, guide, inform and facilitate appropriate STI action at national level, without being overly prescriptive of the national and local-level action that should be undertaken.

3.1.2. Structure of Work Stream 2

99. Three types of policy and institutional interventions are presented in this work stream
    i. Cross-cutting policy and institutional interventions taken directly from the STISA 2024 document and related AU declarations and statements that require implementation and / or promotion by the AUC and related institutions.
    ii. Policy and institutional interventions that require interfacing with ongoing activities linked to the six priority areas of STISA.

iii. Interventions requiring extensive collaboration outside the AU and its Education, Science and Technology Associated Bodies, notably with the UN.

Interventions Related to STISA-2024 and AU Documentation.

100. This section presents the cross-cutting interventions stated in STISA-2024, complemented where indicated, by commitments to interventions made in related AU documentation. Where institutional and policy goals that are stated in STISA-2024 and elsewhere are directly related to another particular work stream then they are covered under that work stream e.g. the establishment of an African STI Fund (ASTIF) and the policy that each Member States is encouraged to take concrete actions to allocate at least 1% of GDP to R&D is covered under work stream 4 on Promoting STI investment.

3.1.3. ASRIC

101. The stated objective of ASRIC, as determined by its Statute (AUC, 2016d) is:

> *"to promote scientific research and innovation in order to address the challenges of Africa's socio-economic development."*

ASRIC serves as an interface between the AU decision making processes of STISA and the implementation processes. ASRIC is overseen by a bureau consisting of Chairs of Academies of Science from each of Africa's five main regions and will operate through three committees; (i) Science and Innovation; (ii) Resource mobilization; and (iii) Communication. The AU Scientific Technical Research Commission (AU-STRC) will act as the Secretariat to ASRIC and will also work closely with AUDA-NEPAD. The role of AUDA-NEPAD is to facilitate and coordinate the implementation of regional and continental priority programmes and projects; to push for partnerships and complementary resource mobilization; and to provide research and knowledge management services

102. ASRIC was formally launched in November 2018 in Abuja. If it works well it should provide a voice for the Science and Technology Community to feed into AU policy and into Regional and National policy and practice. It should also provide a vehicle for policy makers to clearly express what they expect from the Science and Technology community of Africa. It represents a powerful democratisation of, and voice for, science in Africa. If properly managed, it may also offer a strong voice for innovators and industry and provide space for the voices of 'women in science' and 'youth in science' to be heard. As a science / policy interface it is unique in the world.

Target	Timeline	Lead	Partners
ASRIC			AUC-HRST, RECS, UN,

• ASRIC to become fully operational in 2019 and to hold annual meetings of ASRIC Congress.	Oct annually	ASRIC Secretariat	AfDB, AUDA-NEPAD, Private Sector, Professional bodies e.g. Engineers, Academia, Civil Society

3.1.4. Flagship Programmes

103. A major task of ASRIC under STISA-2024 is to identify and oversee flagship programmes. STISA-2024 provided a target of three rounds of 3-year programmes and that

> *"it is envisaged that flagship programs for each priority [area] will be developed and executed under STISA 2024."*

Such programs could, for example, be part of large multinational development projects that require a strong research input to accompany their implementation. An example of how a flagship programme might operate is provided in STISA-2024 (AUC, 2014a).

Target	Timeline	Lead	Partners
Flagship Programmes • At least one round of flagship programmes selected and operational in each priority area. by 2023.	Dec 2023	ASRIC	AUC-HRST, RECS, AUDA-NEPAD, UN, AfDB, Private Sector, Professional bodies e.g. Engineers, Academia, Civil Society

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3.1.5. PAIPO

104. The statute of the Pan African Intellectual Property Organization (PAIPO) was adopted in January 2016 (AUC, 2016e) and will come into force 30 days after 15 Member States have ratified it. It was originally intended that PAIPO should begin its scheduled activities in 2018 and be fully functional by 2023 (AUC, 2017). However, it is yet to begin its activities. The mandate of PAIPO is that it

> *"shall be responsible for intellectual property and other emerging issues related to intellectual property in Africa and shall promote effective use of the intellectual property system as a tool for*

economic, cultural, social and technological development of the continent as well as set intellectual property standards that reflect the needs of the African Union, its Member States, RECs, ARIPO and OAPI."

Target	Timeline	Lead	Partners
PAIPO • PAIPO is established and fully functional by 2023	Dec 2023	AUC-HRST	RECS, UN, AUDA-NEPAD, ARIPO, OAPI

3.1.6. Pan African Quality Assurance and Accreditation Framework

105. In 2012 the AU Executive Council made a decision to establish a continental Accreditation Agency for Higher Education.[30] In 2014, with support from UNESCO, the African Region agreed the Addis Declaration, a

> *"Revised Convention on the Recognition of Studies, Certificates, Diplomas, Degrees and Other Academic Qualifications in Higher Education in African States."* (UNESCO, 2014).

In response to these decisions the African Union Commission (AUC) with support from the European Association for Quality Assurance in Higher Education (ENQA) and in partnership with the Association of African Universities, has initiated the development of a Pan-African Quality Assurance and Accreditation Framework (PAQAF)[31] (Okebukola, & Fonteyne, 2014). The AU-C10 Action Plan contains targets, based on the Agenda 2063 Implementation Plan (Goal 2, Priority Area 1) to ratify the Addis Declaration and advance the implementation of the Pan African Quality Assurance Framework. Agenda 2063 provides targets for national accreditation systems. These frameworks will also need to take special note of quality assurance practices for virtual e-learning universities (see section 4.2.6).

Target	Timeline	Lead	Partners
Pan African Quality Assurance and Accreditation Framework			
• Expedite ratification of the Addis Convention	Ongoing	AUC	UNESCO, Member States

[30] https://au.int/en/decisions/council
[31] http://www.universityworldnews.com/article.php?story=20171117090752810

• Initiate the development of African Qualification Frameworks including TVET	Jun 2019	AUC	RECS, EU, GIZ, AAU, UNESCO, ILO, ADEA, CAPA
• Operationalize the establishment of the Continental Quality Assurance and Accreditation Agency	Dec 2020	AUC	AAU, EU, UNESCO, National / Regional agencies
• Provide support such that at least 50% Member States have national accreditation systems in place	Dec 2023	AUC	RECS, UNESCO Member States

3.1.7. Pan African University

106. The Agenda 2063 10-year Implementation Plan states that the Pan African University should be consolidated with at least 25 satellite centres by 2023.

Target	Timeline	Lead	Partners
Pan African University • Pan African University consolidated with at least 25 satellite centres	Dec 2023	PAU	AUC UNESCO RECS, Member States

3.1.8. Africa Virtual and E-Learning University

107. The establishment of an African e-University was part of the Agenda 2063 10-year Implementation Plan. The AU Assembly have decided that an Africa Virtual and E-learning university should operate under the auspices of the Pan African University (AUC, 2017b)[32] A previous institution, the African Virtual University will be incorporated into the Pan African University (PAU) moving from Nairobi to Yaoundé, the location of the rectorate of the PAU. This provides an opportunity to massively increase the numbers of students able to study at both undergraduate and postgraduate research level, stimulating research generally, including STI related research.

Target	Timeline	Lead	Partners
Africa Virtual and E-Learning University • Support the development of the Africa Virtual and E-Learning University under the PAU and	Annual	PAU	AUC. RECS

[32] https://thepienews.com/news/pan-african-university-to-have-an-odel-wing/

annually document the following, including for STEM and STI-related programmes ○ increased number of programmes ○ increased number of students enrolled ○ Increased number of students graduating			UNESCO, Member States AAU

3.1.9. Pan-African Institute for Statistics

108. The Agenda 2063 10-year Implementation Plan provided that the Strategy for Harmonisation of Statistics in Africa (SHaSA II) (AUC, AfDB, ECA and ACBF, 2017) be developed and that The Pan African Institute of Statistics[33] is fully functional by 2023.

Target	Timeline	Lead	Partners
Pan-African Institute for Statistics • The Pan African Institute of Statistics is fully functional by 2023	Dec 2023	AUC-DEA	EU, RECS, UNESCO, National Statistics Offices

3.1.10. Establish a Think Tank of African Expertise to Support the AU-C10

109. The Lilongwe Declaration from the First Extra-Ordinary Summit for the Committee of Ten Heads of State and Government (AU-C10) championing Education, Science and Technology held from 2nd–3rd November, Lilongwe, Malawi (AU 2018b) stipulated that a Think Tank be established to support them. Such a think tank could also play a broader role in providing guidance to STISA.

Target	Timeline	Lead	Partners
Think Tank of African Expertise to Support the AU-C10 • Establish a Think Tank to support the AU Committee of Ten Heads of State and Government (AU-C10), Championing Education, Science and Technology in Africa ○ Prepare a Terms of Reference for C-10 Task Force / Advisory Group ○ Identify and appoint members of the Task Force / Advisory Group	Sep 2019 Apr 2019 Jun 2019	AUC-HRST	RECS, UN, AUDA-NEPAD, ASRIC, AAS, AfDB, Private Sector, Civil Society, Academia,

[33] https://au.int/en/ea/statistics/statafric

○ Convene a first annual meeting of the Task Force / Advisory Group	Sep 2019		Professional bodies e.g. Engineers

3.1.11. Regional and National Frameworks for Actions on STI

110. STISA-2024 stresses the need for regional and national STI strategies and frameworks. Many member states and regional economic communities have developed STI policies and strategies, though some may require further updating to more fully incorporate the concepts of innovation (AOSTI, 2013) (ECA, AUC and AfDB, 2016) (ECA, 2018). It is recognised that not all countries are at the same level of capability with respect to STI policy, strategy and frameworks for monitoring and evaluation and implementation (ACBF, 2017). Furthermore, if the national plans are developed in isolation, they may lack coherence and work against regional, and ultimately continental, integration. One way to address this would be for each REC to convene its member states and collectively review their current strategies with a view to ensuring coherence and harmonisation between them at regional level.

Target	Timeline	Lead	Partners
Regional and National Frameworks for Actions on STI • Establish instruments to provide strategic collaboration and partnership with RECS, such that each Regional Economic Community has in place an up to date gender responsive STI policy, strategy, M&E framework and implementation plan (or their equivalents) with appropriate indicators and targets taking into account short term, medium term and long-term priorities, that are internally coherent and consistent and incorporate strong innovation components, as well as S&T, and cascading this approach to member states.	Dec 2023	AUC-HRST	RECs, AUDA-NEPAD ASRIC, AOSTI, UN, Private Sector, Academia, Professional bodies e.g. Engineers, Civil Society, Member States

Interventions Linked to the Six Priority Areas

111. The previous section focused on cross-cutting STI objectives and targets. This section focuses on the six priority areas of STISA outlined in Table 1.1. These areas relate to sectoral areas, which in several cases already have strong organisational structures and networks of activities, including some dedicated AU and / or UN programmes.

112. The STISA architecture and its associated decision-making bodies and implementing bodies need to interface with the sectoral agencies operating and coordinating activities within the six priority areas. Similarly, at national level, ministries overseeing science technology and innovation need to interface with sectoral ministries such as agriculture and health, as the science, technology and innovation may best be managed from within the relevant sector, rather than by the STI ministry. A strong partnership between the STI organisations and sectoral groupings, e.g. through financing and / or technical support, can help drive innovation and accompanying economic development through both business development and public sector activity.

113. This type of organisation involving both cross-cutting breadth and sectorial depth may be described as a T-shaped knowledge management structure (Barile, Franco, Nota, & Saviano, 2012) where the cross at the top of the T represents 'breadth' of knowledge and the down stroke represents 'depth' of knowledge. The application of this concept to STISA management is illustrated in Figure 4.1. The following paragraphs provide some information on the organisations and institutions from within the priority areas with which STISA will need to engage and partner to deliver on STISA's mission.

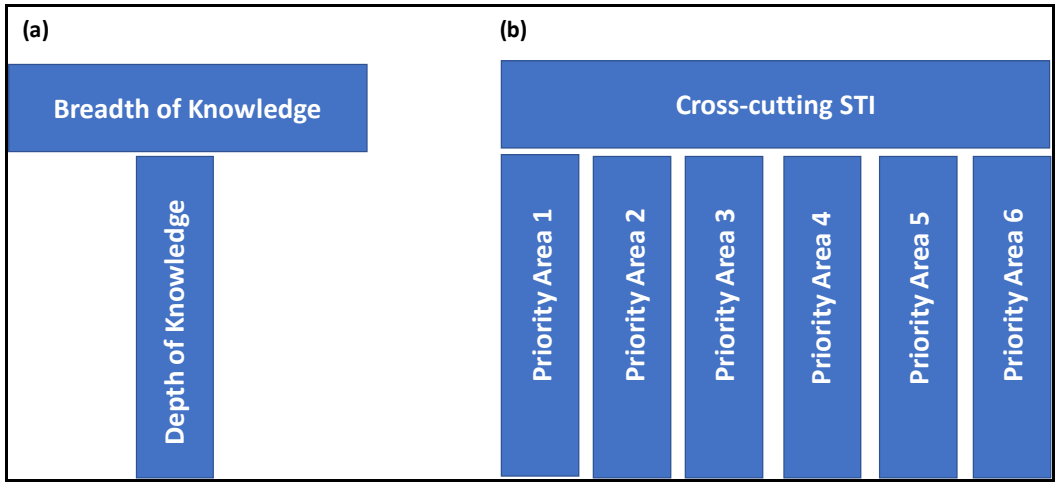

Figure 4.1. Adaptation of T-shaped knowledge management model for STISA. (a) T-shape illustrating concept combining cross-cutting breadth of knowledge with depth of a particular area of knowledge. (b) Application of this concept for the interface between STI broadly and the six priority areas of STISA

114. **Priority Area 1: Eradication of hunger and achieving food security.** While working with RECs and member states, STISA needs to engage with partners of the Comprehensive African Agriculture Development Programme (CAADP) which provides the framework for agricultural development across the continent (AUC, 2018d). Among the many relevant research-associated organisations operating on the continent, STISA in

particular needs to closely engage with The Forum for Agricultural Research in Africa (FARA)[34], which is the apex continental organization responsible for coordinating and advocating for agricultural research-for-development and serves as the technical arm of the African Union Commission on matters concerning agriculture science, technology and innovation. There is also need to engage with the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM)[35] with which the AUC has a MoU related to this priority area. Both of these organizations strongly support CAADP, along with many other stakeholders.

115. **Priority Area 2: Prevention and control of diseases.** There is no overarching programme for health on the continent although there is of course the African Regional Office and the Eastern Mediterranean Office of the World Health Organization, which have representative offices in African Union countries and work closely with the African Union. In addition to working with RECS, member states and WHO, there are other continental organisations that STISA needs to engage. These include the recently established Africa Centres for Disease Control and Prevention (Africa CDC),[36] and the Alliance for Accelerating Excellence in Science in Africa, AESA[37], an initiative of the African Academy of Sciences and NEPAD, which funds health research and is supported by the Wellcome Trust, the Gates Foundation and other development partners, including UK DfID.

116. **Priority Area 3: Communication (Physical & Intellectual Mobility).** While working with RECs and member states, STISA needs to engage with The Programme on Infrastructure Development for Africa (PIDA),[38] which is executed by the African Union Commission, AUDA-NEPAD and the African Development Bank. It operates over 50 major cross-border projects in the areas of transport, energy, transboundary water and ICT and may serve as a major source of expertise and capacity building at all levels of science, technology and engineering and their associated management. STISA also needs to engage with several pan-African ICT network initiatives, notably Africa Connect 2,[39] co-funded with the European Union, that links African educational and research networks with external partners.

117. **Priority Area 4: Protection of our space.** While working with RECs and member states, STISA needs to engage with those institutions participating in developing and implementing the African Space Strategy[40] (AUC, 2016c) and establishing the African Space Agency[41] (AUC, 2017c) (Kazeem,

[34] https://faraafrica.org/
[35] http://www.ruforum.org/
[36] http://www.africacdc.org/
[37] https://aesa.ac.ke/
[38] http://www.au-pida.org/
[39] https://www.africaconnect2.net/Pages/Home.aspx
[40] https://au.int/sites/default/files/newsevents/workingdocuments/33178-wd-african_space_strategy_-_st20445_e_original.pdf
[41] https://au.int/sites/default/files/newsevents/workingdocuments/33178-wd-st20676_e_original.pdf

2019). Much of the space strategy is related to space-derived earth observation data for environmental and security applications. A good overview of African Space Science is available (Povic, et al., 2018). This priority area also requires engagement with environmentalists and those involved in Disaster Management, where there is a strong interface with many of the organisations associated with Priority Area 1.

118. **Priority Area 5: Live together–build the society.** In order to deliver on this priority area STISA needs to engage with the socio-economic, political and business sectors on how to build a society that can adapt to future changes associated with e.g. urbanisation, Pan-Africanism, regional integration, changing demographics and democratisation. While working with RECs and member states, potential partner institutions for continental engagement could be the Africa Urban Agenda Programme (UN Habitat and ECA, 2015) the African Union of Architects (AUA)[42], the Organisation for Social Science Research in Eastern and Southern Africa (OSSREA),[43] and The Council for the Development of Social Science Research in Africa (CODESIRA).[44]

119. **Priority Area 6: Wealth creation**. STISA needs to engage with the Political, Financial and Trade sectors, while working with RECs and member states, to help build an environment with adequately trained human resources for strengthening creativity and technological innovation. This could bring about entrepreneurship in new technological frontiers, which needs to also be consistent with the sustainable management of natural resources. This will require an interface with African continental institutions associated with finance (AfDB, Afreximbank), business (e.g. Business Africa[45], Africa CEO Forum[46]), capacity building (ACBF)[47] and academia (AAU[48] and AAS[49]). The recent establishment of the Pan-African Private Sector Trade and Investment Committee (PAFTRAC)[50] with a secretariat hosted at Afreximbank also provides a potential focal point for interaction. In addition, there are two flagship projects associated with Agenda 2063 that link to wealth creation with which STISA could interface: the African Virtual and E-Learning University (AUC, 2017b) and the Blue/ocean economy (ECA, 2016a)

[42] https://www.aua.archi/
[43] http://www.ossrea.net/
[44] https://www.codesira.org
[45] http://www.businessafrica-emp.org/
[46] https://www.theafricaceoforum.com/en/
[47] https://www.acbf-pact.org/
[48] https://www.aau.org/
[49] https://aasciences.ac.ke/
[50] https://au.int/en/newsevents/20181019/pan-african-private-sector-trade-and-investment-committee-brief

120. Some of these priority areas have well developed communities that are pushing forward with the development agenda of that area (Priorities 1, 2, 3 and 4) However, other priority areas (Priorities 5 and 6) are, by their nature, more amorphous and consist of disparate groupings and players that are not frequently in contact. It may be important to bring together the different players involved in Priority Areas 5 and 6, and help create functional partnerships so that coherent STI strategies and action plans can be developed for these areas across the continent.

Target	Timeline	Lead	Partners
Interventions Linked to the Six Priority Areas • Establish instruments to facilitate engagement between the central STISA policy and implementing bodies (AUC, AUDA-NEPAD, ASRIC) and the lead stakeholder communities and agencies engaged in all six priority areas, namely: 1. Eradication of hunger and achieving food security; 2. Prevention and Control of Diseases; 3. Communication (Physical and Intellectual Mobility); 4. Protect our Space; 5. Live together – build the society; and 6. Wealth Creation, such that the instruments facilitate the mobilisation of relevant actors to recognise, support and actively engage in STISA and STISA-relevant activities; o That in so doing, full account is taken of other programmes and plans established by the AU relating to Science and Technology such as the CAADP; AADP, PIDA; AIDA; PMPA; and the African Space Strategy; and o That where there is no strong identifiable overarching community or body available to cover the priority area, such as in Priority Area 5 and 6, the central STISA bodies coordinate and develop the necessary structures, linkages and communities for the development of a functional interface.	Dec 2019	AUC-STRC	RECS, Member States, UN, AUC-HRST, AUDA-NEPAD, ASRIC, AOSTI, AfDB, Sectoral Stakeholders Private Sector, Academia, Professional bodies e.g. Engineers, Civil Society

Continental Partnerships for STISA. Reinforcing Science Diplomacy.

121. This section outlines some critical high-level partnerships that the lead agencies of STISA need to maintain and deepen with organisations that lie outside the Governance structures outlined in Figure 1.3. In particular, there is a need to connect with key UN bodies and to interface with trade and industry, including through the private sector. These partnerships can help reinforce Science Diplomacy as a tool for realising the objectives of STISA.

3.1.12. UN Agencies and Regional Coordinating Mechanism

122. UN engagement with the African Union provides support through a number of agencies. For example:
    - UNESCO has previously interfaced substantively with the African Union to promote Science and Technology in Africa (UNESCO, 2007). UNESCO currently has two global priorities driving its agenda, one of them being Priority Africa (UNESCO, 2013) and the second being the Gender Equality Action Plan (AUC, 2013) . Three of six flagship programmes under Priority Africa relate to Education and STI; (i) Strengthening education systems for sustainable development in Africa: improving equity, quality and relevance; (ii) Harnessing STI and knowledge for the sustainable socio-economic development of Africa; and (iii) Fostering science for the sustainable management of Africa's natural resources and disaster risk reduction. UNESCO also has an extensive network throughout the continent of STI and research related activities, supported through the African Network of Scientific and Technological Institutions (ANSTI)[51] and the UNESCO Institute for Statistics available for potential partnership and collaboration.
    - The ECA has substantial expertise in economic development and aspects of innovation, industry and trade, that may assist STISA in bridging the gap from Science and R&D to innovation, entrepreneurship and industrial development.

123. The Regional Coordination Mechanism (RCM) is a high-level body overseeing UN-AU collaborations. It operates a cluster system that is comprised of both UN and AU entities at the continental level, and of the UN System and the RECs at regional levels. This system enhances coordination, communication and collaboration in the implementation of various programmes and activities. The cluster system is currently structured around thematic areas covering the priorities of AUDA-NEPAD, including Science and Technology. RCM has developed a framework for a renewed UN/AU Partnership on Africa's Integration and Development Agenda (PAIDA) covering the period 2017-2027 (RCM-Africa, 2015). Engagement with STISA could operate through Cluster 3, which has the

[51] https://www.ansti.org

Theme: Human Capital Development, Health, Nutrition, Science, Technology and Innovation.

Target	Timeline	Lead	Partners
Partnership with UN agencies and Regional Coordinating Mechanism (RCM) • Establish STISA with high visibility and priority within the RCM draft work plan, noting o The relevance of STISA to the Cluster on Human Capital Development, Health, Nutrition, Science, Technology and Innovation, especially sub-Clusters on Science and Technology and Education and Human resources o The large number of UN agencies, joint working groups and mechanisms e.g. Joint UN Technology Facilitation Mechanism, that may be taken advantage of by STISA through AU-UN coordination	Jan 2020	UNESCO	AUC, UN, AUDA-NEPAD.

3.1.13. Pan-African Private Sector Engagement

124. Pan-African Trade and Investment Committee (PAFTRAC). The ease of doing business and the ease of undertaking cross-border trade are critical elements of delivering the fruits of STI. A senior experts dialogue (ECA, 2017) concluded that the existing trade and industrial policies across the region do not adequately accommodate the role of STI. Similarly, many STI agendas across the continent, including STISA itself, do not adequately accommodate trade and industry policies. The recently re-established Pan-African Private Sector Trade and Investment Committee (PAFTRAC), hosted by Afreximbank in partnership with the AU, is a body that may facilitate STISA engagement in the Trade and Industry space and be able to provide feedback on priority areas for STI investment.

Target	**Timeline**	**Lead**	**Partners**
Pan-African Trade and Investment Committee (PAFTRAC) • Develop a functional interface with PAFTRAC so that the inclusion of Industry, Trade and	Dec 2019	AUC-HRST	PAFTRAC, Private Sector AUDA-NEPAD,

Investment components are mainstreamed within STISA			ASRIC, AUC-EA, AUC-DTI

125. **African Union Private Sector Forum.** The AU Department of Economic Affairs organises an annual Private Sector Forum, providing an interface between AU Strategy and Policy and the Private Sector. Science, Technology and Innovation is frequently an integral component of such meetings. For example, the 9th Forum was co-hosted with the Department of Science and Technology in South Africa.[52] The forum provides a potential interface for the private sector to be more strongly integrated into STISA.

Target	Timeline	Lead	Partners
Private Sector Forum • STISA is formally represented and makes a presentation at each Private Sector Forum, supported by side meetings to strengthen the Private Sector interface.	Annually	AUC-HRST	Private Sector Forum, ASRIC AUDA-NEPAD,

4. Work Stream 3: Research and Innovation

Background

126. This work stream on Research and Innovation builds on work stream 2 on policy and institutional interventions. It covers the strategies, implementation mechanisms and activities needed on the ground at country level to guarantee the growth of science, technology and associated research and development on the one hand, and innovation, entrepreneurship and associated industrial growth and trade on the other hand. This section focuses on actions that will support the work of many individuals and organisations: in academia; government; the private sector, including financiers; and the private non-profit sectors. This work stream strives for enhanced R&D and the development of businesses and entrepreneurship, including social entrepreneurship.

4.1.1. Some Lessons from the Global Innovation Index

127. Innovation is now widely recognized as a central driver of economic growth and development. The Global Innovation Index (Cornell University, INSEAD, and WIPO, 2018) described in section 1.5 and covering 126 countries, is currently the best tool available to assess the low and middle-income countries of Africa. The 2018 Global Innovation Index cites China's rise in the Global Innovation Index rankings over the last few years as spectacular. It is noteworthy that this growth has coincided not just with business growth, but also a massive expansion of Higher Education and

[52] https://au.int/sites/default/files/newsevents/programmes/33024-pg-9th_aupsf_conference_handbook_print_web_small.pdf

high-quality academic research. The 2018 Index also identifies 20 countries that outperform on innovation relative to their level of development. Within these 20 economies, six in total, the most from any region, come from Sub-Saharan Africa. Importantly, Kenya, Rwanda, Mozambique, Malawi, and Madagascar stand out for being innovation achievers at least three times in the previous eight years. South Africa is the sixth country on the list.

128. It is recognised that innovation activities are not evenly spread within innovative countries. Instead, they tend to geographically concentrate in specific clusters, often around specific areas of expertise. An example of this phenomenon is the famous Silicon Valley in California, which has led to, and attracted, many start-up companies engaged in high technology and social media, including Apple, Facebook and Google. It is noteworthy that Silicon Valley is also the site of technology-focused institutions centered around Palo Alto's Stanford University. The power of this phenomenon of an academic and business interface is demonstrated by the outstanding patent and scientific publishing performance of the Silicon Valley region. It is therefore important that African countries facilitate the development of clusters of innovation that have a critical mass of research, innovation and entrepreneurship capacity.

4.1.2. Continental Support for Higher Education and Research Capabilities

129. There have been several notable developments in Higher Education and sectoral research funding, especially for health, agriculture and the environment, since the turn of the century. These include:
    - The massification and expansion of Higher Education across Africa, substantially financed through the African public sector, with private sector investment and supplemented by student fees. This has provided an increased population (though still low by global standards) educated to degree level. This has also, however, created challenges for universities as they seek to maintain the quality of education, while expanding access.
    - An increased inflow of development assistance, especially in the fields of health, agriculture and the environment, in response to the Millennium Development Goals and the broader development agenda, now enunciated through the Sustainable Development Goals and Agenda 2063.
    - An increased level of competitive research funding and research partnership development from the US Government, European Governments and European Union sources, that have increasingly placed some funds at the disposal of African researchers.
    - The substantive injection of funds from the Bill and Melinda Gates Foundation, supplemented by other Foundations such as the Wellcome Trust, which have focused on technology driven solutions, especially for health.

- The development of national research agencies providing limited national resources for research overall, but taking note in particular of the growing success and impact of South African and Egyptian Higher Education and research.

130. These developments have been supplemented by an increased commitment to, and financing of, Higher Education development by the African Development Bank and World Bank. The Development Banks primarily finance their initiatives through loans to national Governments. These funds therefore represent African Government funding and ownership of the investment, in the same way as an individual taking a personal loan to buy a car or a house, represents a resource commitment, and ownership, by that individual.

131. The African Development Bank recognised that most development agencies were focused on basic education. It has therefore provided finance to a number of Governments for Higher Education and Vocational Training through both grants and loans, first for a **Higher Education Science and Technology (HEST) Strategy** in 2008 (African Development Bank, 2008) and then for a **Human Capital Strategy** in 2014 (African Development Bank, 2014). Total funds for these activities total over UA[53] 500 million.

132. The World Bank initiated its re-engagement with the Higher Education sector through a Task Force on Higher Education and Society (2000). A seminal study (World Bank, 2008) strongly justified investing in Higher Education. Among other data and analysis, the study demonstrated that a one-year increase in average tertiary education levels would raise annual GDP growth in Sub-Saharan Africa by 0.39 percentage points and increase the long-run steady state level of African GDP per capita by 12 percent. This in turn led to policy recommendations for World Bank financing of Higher Education (Experton & Fevre, 2010). The World Bank invested US$ 1.9 billion in higher education in Africa between 2003 and 2014 (Independent Evaluation Group, 2015). The Independent Evaluation Group (2017) of the World Bank recently further evaluated World Bank support of Higher Education.

133. A recent continental example of World Bank financing is the **African Centres of Excellence (ACE) programme** (World Bank, 2017) (Nordling, 2018) with support and coordination from within Africa by the Association of African Universities and the Inter-University Council for East Africa (IUCEA). A total of over US$ 500 million has been committed so far through three calls for proposals, two covering in West Africa and one covering East and Southern Africa. A further example of investment in higher education,

[53] UA is the official currency for the AfDB projects. 1 UA=1 SDR (International Monetary Fund Special Drawing Rights).

for which calls have been issued but no awards yet made, is the World Bank financed **Strengthening Higher Agricultural Education in Africa (SHAEA) programme**[54], with oversight provide by Ruforum. A total of US$190 million in financing from the International Development Association (IDA) is envisaged for this programme targeting six countries.[55]

134. An initiative that deserves a special mention is the recently created **Alliance for Accelerating Excellence in Science in Africa (AESA)**,[56] an initiative of the African Academy of Sciences and AUDA-NEPAD based in Nairobi. The initiative is supported financially by the Wellcome Trust, the Gates Foundation and other development partners, notably UK DfID. AESA provides an avenue for competitive grant and capacity building support for research from across the continent. The funds available are substantially higher than from most national research agencies in Africa. AESA explicitly states that it has been established in support of STISA-2024. It is developing a strong focus on innovation and is becoming more transdisciplinary in its approach. To date AESA has raised over US$ 200 million to finance its activities.

135. The **African Union Research Grant Programme**,[57] which is supported in large part by the European Union, has been in operation since 2010, and provides a continent-wide opportunity for substantial research funding. There have been four calls and US$ 35 million has been disbursed to collaborative projects involving 36 African countries and 9 European countries. This has resulted in 218 Masters graduates, 35 PhD graduates and 111 peer reviewed scientific publications. It

136. The work of the **African Union High Level Panel on Emerging Technologies (APET)** initiated and managed by AUDA-NEPAD and AUC-HRST, complements many of the initiatives mentioned above in that it reviews emerging technologies and seeks to establish and promote their relevance for Africa. They have recently produced three studies on: (i) Gene Drives for Malaria Control and Elimination in Africa (NEPAD, 2018a) ; (ii) Drones on the Horizon: Transforming Africa's Agriculture (NEPAD, 2018b); and (iii) Micro-grids: Empowering Communities and Enabling Transformation in Africa (NEPAD, 2018c).

137. This brief review of Higher Education and research in Africa is not by any means exhaustive. Many sectoral initiatives exist that will feed into the priority areas of STISA, notably in health (Priority 2), agriculture (Priority 1) and the environment (priorities 1 and 4). One additional initiative that has been developed from within Africa, with support from the AU and the EU

[54] http://www.ruforum.org/SHAEA/
[55] https://www.worldbank.org/en/events/2018/09/06/call-for-proposals-strengthening-higher-agricultural-education-in-africa-shaea
[56] https://aesa.ac.ke/
[57] https://au.int/en/aurg

over a number of years however deserves a special mention. This is the **African Space Policy** (AUC, 2016c) and the plans to establish the African Space Agency[58] (AUC, 2017c) (Priority 4). This strategy shifts the balance in African technology development and research from science towards engineering. It opens up the world of satellite and communications technology and Big Data management. It is also, by its nature, integrative across the continent. Its success will provide a major impetus to technology and innovation development across the continent in the coming years.

138. In summary, there has been a substantive increase in science, technology and research across the continent. However, three main issues need to be clearly stated and addressed if STISA is to succeed.
    - Much of the new research related initiatives, with the exception of the African Development Bank and World Bank financed programmes operating through Government loans, are being funded, almost in their entirety, by non-African development partners and private non-profit organisations such as the Gates Foundation. More African sourced research funding and African-originated programmes are needed to enable a true African ownership of this process.
    - Much of the resources available for research are for current expenditure, including equipment. There is a desperate need for improved high-quality buildings, research laboratories and associated infrastructure (ICT, electricity, water to name a few). If these facilities are not developed on a massive scale then African Science, Technology and Innovation will never be able to compete globally.
    - Much of the research, with the possible exception of agricultural research, is at an early stage in the innovation pathway. Substantive further investment will be needed to take promising research results through to an innovation that provides a market return or a social return on investment. Many projects will fail for every one that succeeds. The bridge to market and social utility is covered in the next section on innovation and entrepreneurship.

4.1.3. Innovation and Entrepreneurship

139. There is a burning energy among the youth of Africa. Many young people, unable to get a job after they have completed secondary school or university, are seeking to establish social enterprises and businesses. There is a fearlessness among them. They have nothing to lose by failure as they cannot be worse off than they already are, without a job and without any social welfare to support them. There is also an idealism and optimism borne from youth that drives them. They yearn for success and the rewards

[58] https://au.int/sites/default/files/newsevents/workingdocuments/33178-wd-st20676_e_original.pdf

that success will bring for them personally, for their families, for their countries and for Africa.

140. A survey of eight sub-Saharan African countries addressed six indicators of entrepreneurship (Amorós & Bosma, 2014). It was found that:
    - 67% of Malawians aged 18-64 expect to start a new business within the next three years.
    - 40% of Nigerans and Zambians aged 18-64 are either a nascent entrepreneur or owner-manager of a new business.
    - 85% of Nigerians aged 18-64 population (individuals involved in any stage of entrepreneurial activity excluded) see good opportunities to start a firm in the area where they live.
    - 90% of Malawians aged 18-64 (individuals involved in any stage of entrepreneurial activity excluded) believe they have the required skills and knowledge to start a business.
    - 15% of Ugandans aged 18-64 (individuals involved in any stage of entrepreneurial activity excluded) indicate that fear of failure would prevent them from setting up a business.
    - 23% of Zambians aged 18-64 are currently a nascent entrepreneur i.e. actively involved in setting up a business they will own or co-own; this business has not paid salaries, wages, or any other payments to the owners for more than three months.

141. There is a massive expansion of technological innovation hubs on the continent (Bayen & Giuliani, 2018). Research in early 2018 reported that from 314 hubs in 2016, the number of active tech hubs across Africa grew by over 50 to a total of 442 hubs in 2018, with many more hubs due for launch. The continental distribution of the hubs is presented in Figure 5.1. Many of the hubs are clustered in particular cities. The strongest five cities, at the time of the report, were: Lagos (31 hubs); Cape Town (26 hubs); Nairobi (25 hubs); Cairo (23 hubs) and Accra (16 hubs). Interestingly substantial growth in tech hubs is being seen across the continent, albeit sometimes from a low level, for example in DRC, Zambia, Cote d'Ivoire and Togo. Recently Google and Facebook established hubs in Lagos, reinforcing its emerging status as a startup leader on the continent.[59]

142. Following on from experiences elsewhere in the world, one would expect African universities to engage with, and initiate, the establishment of tech hubs. This is beginning to happen,[60] for example at the University of Nairobi, the American University in Cairo, Stellenbosch and Cape Town.[61] Nigeria has recently announced plans to build technology hubs at its universities.[62]

[59] https://qz.com/africa/1137474/facebook-google-mest-opening-tech-hubs-in-lagos-nigeria/
[60] https://scitechafrica.com/2018/08/01/why-african-universities-must-have-innovation-hub-on-campus/
[61] https://www.forbesafrica.com/technology/2018/07/30/africas-new-silicon-valleys/
[62] http://dailypost.ng/2018/03/06/nigerian-govt-build-technology-hubs-universities/

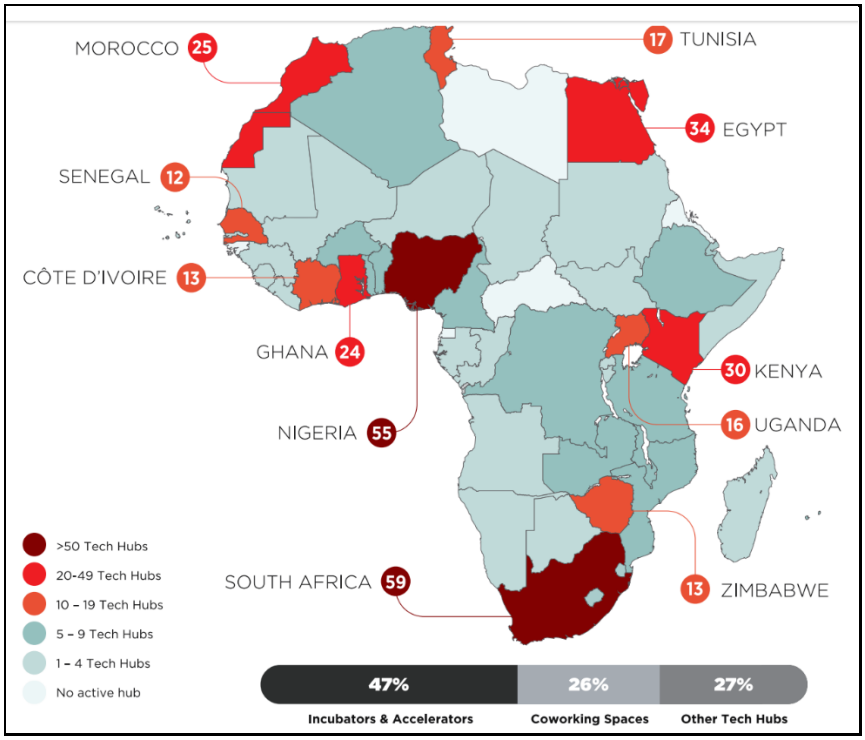

Figure 5.1. Map of spread of technical hubs by country. Reprinted from (Bayen & Giuliani, 2018) Permission to reproduce figure has been requested.

143. A consequence of the growth of technology hubs is that there has been a rapid increase in start-up ventures. Partech Ventures' 2018 analysis[63,64] shows that venture capital funding in 2017 was US$ 560 million, recording a 53% year on year growth. South Africa, Kenya and Nigeria each attracted over USD100 million venture investment each for startups.

144. Over 16 Foundations, forums and prizes for entrepreneurship have been established in recent years to promote entrepreneurship and associated innovation. Among the most significant are: (i) the Tony **Elumelu Foundation,**[65] promoting a philosophy of 'Africapitalism' through grants and mentorship support**,** which positions Africa's private sector, and most importantly entrepreneurs, as the catalyst for the social and economic development of the continent**; (ii) The Next Einstein Forum,**[66] which hosts a major high-profile meeting every two years, with many interim activities, to promote and explore African Science, Technology and Innovation, including through a 'Challenge of Invention to Innovation (Ci2i)' competition. The Next Einstein Forum is an initiative of the African Institute for Mathematical Sciences (AIMS) in partnership with the Robert Bosch Stiftung; (iii) **Global innovation Exchange**,[67] a tech platform, whose

[63] https://qz.com/africa/1211233/how-much-did-african-startups-raise-in-2017-partech-disrupt-africa/
[64] https://www.linkedin.com/pulse/another-record-breaking-year-african-tech-start-ups-raised-collon/
[65] http://tonyelumelufoundation.org/
[66] https://nef.org/
[67] https://www.globalinnovationexchange.org/

mission is ‘to accelerate innovation in developing countries, using a database of innovations and funding opportunities to reveal curated content and industry insights for social entrepreneurs, for the funders who fund them, and for other development professionals’; and (iv) the **Africa Innovation Summit**,[68] which brings together heads of state, ministers and policy makers, CEOs and leaders of industry, capital market operators, investors and academics to promote and build an enabling environment for innovation in Africa.

145. An increasing number of African universities, following the lead of universities globally, are also now starting to develop academic degree programmes in innovation and entrepreneurship.

4.1.4. Structure of Work Stream 3

146. This work stream has two major components. The first builds on the activities of work stream 2, to outline specific actions, with defined targets, that can be undertaken within the STISA architecture to promote coherent action to promote R&D, innovation and entrepreneurship on the continent. The second is a list of actions that are not presented as definitive actions with targets, but as guidance and suggestions that RECs and member states, together with other interested actors, may wish to take into account as they are developing their own plans to promote STI. Each Section is presented under the four pillars of STISA, namely (i) Infrastructure Development; (ii) Technical Competences; (iii) Innovation & Entrepreneurship; and (iv) Enabling Environment.

Work Stream Actions with Defined Targets

4.1.5. Infrastructure Development;

147. There has been a recent injection of resources for Science and Research in Africa, notably through World Bank financing of the African Centres of Excellence Projects (World Bank, 2017) (Nordling, 2018). This however needs to be expanded and maintained. The African Regional Report on the SDG’s (ECA, AUC and AfDB, 2015) proposed three targets to enhance the quality of African Universities for science, technology and research in each country and to upgrade AUDA/NEPAD centres of excellence. Other targets can also be deduced from the literature, including that outlined in section 1.8.

[68] https://www.africainnovationsummit.com/

Target	Timeline	Lead	Partners
Infrastructure Development • Develop instruments, policies and programmes to support RECS in their work with member states to develop STI infrastructure, including engineering infrastructure, noting the following targets already stated or inferred within AU documentation and items provided as general guidance from the literature o Standards of at least one science and technology university in each African country be raised to benchmarked world-class standard in training and research by 2020Initiate a process in each country to establish at least three world-class centres of excellence in science, technology and innovations in each African country by 2030 to drive innovations and the application of new knowledge in agriculture, industry and services o Establish at least three world-class centres of excellence in science, technology and innovations in each African country by 2030 to drive innovations and the application of new knowledge in agriculture, industry and services o Resource and upgrade NEPAD Centres of Excellence in biosciences, water sciences, laser technology, mathematical sciences, among others, to attain global standards by 2025 o Increased public sector investment in STI and research infrastructure including laboratories and institutes in 2024 compared to 2014; o Increased private sector investment in STI and research infrastructure including laboratories and institutes in 2024 compared to 2014; and. o Increased public-private partnerships in higher education and research infrastructure development o Increased Foreign Direct Investment to STI	Dec 2020	AUC-HRSTs	AUDA-NEPAD, AUC-DIE, UN, RECS, Development Banks, Development Partners Academia Professional bodies e.g. Engineers Private Sector Civil Society

4.1.6. Technical Competences

148. There are two major areas of technical competence provided as targets in the African Union and related literature, namely PhD scientists and post-secondary TVET skills development. These are outlined below. However, the overall objective must be to create skilled scientists, technicians and technologists, engineers and mathematicians (STEM) with expertise relevant at all levels of learning and practice. This needs to range from post-secondary artisans and technicians through degree level STEM professionals to postgraduate and post-doctoral researchers and professional managers of science, technology and innovation.

149. **Expanding Postgraduate (PhD) Education.** Many resources have been made available over the years, and continue to be made available, for sending African scholars overseas for postgraduate training. This is an expensive and ultimately unsustainable approach. PhD students are the engine of academic research. Given the increased level of PhD qualified academics now available on the continent to supervise home-grown PhD students, there is an urgent need that more PhD programmes are initiated and supported within the continent. This will both expand PhD qualified personnel and expand research on the continent. The World Bank Centres of Excellence Project is contributing to this expansion, along with other continental initiatives. In this regard African Regional Report on SDGs recommended that at least 1000 highly qualified scientists (PhD) should be trained annually and the AU-C10 Action Plan stated that a fund should be created to train female staff to address gender equality.

150. **Expanding post-secondary education.** The Agenda 2063 10-year implementation plan sets a number of targets for secondary and post-secondary education by 2023, with an emphasis on TVET skills.

Target	Timeline	Lead	Partners
Technical Competences • Develop instruments, policies and programmes to support RECS in their work with member states to develop technical competences, including engineering competences, noting the following targets already stated or inferred within AU documentation and items provided as general guidance from the literature **PhD training** ○ That countries demonstrate an increase in STEM PhD programmes and students in 2024 compared to 2014:	Dec 2020	AUC-HRST	AUC, UN, RECS, member States, Development Banks, ADEA, AAU, CAMA, Development Partners Academia Professional bodies e.g. Engineers Private Sector

○ Train at least 1000 highly qualified scientists (PhD) annually on the continent ○ To commit a special fund(s) to facilitate the training of female university members of staff and women in general to PhD level in support Agenda 2063 vision of quality education and gender equality. **Post-secondary education targets, including TVET** ○ Increase numbers of qualified teachers with focus on STEM by 30% ○ Universal secondary school enrolment of 100% ○ 30% secondary school leavers progress to tertiary education with 40% being female ○ 70% of school leavers not progressing to tertiary education are provided with options for further TVET skills development			Civil Society

4.1.7. Innovation & Entrepreneurship

151. A number of countries and their universities, firms and civil society are actively promoting innovation and entrepreneurship. For example, there has been a major investment in technology hubs across the continent (Bayen & Giuliani, 2018). Further to this, the Agenda 2063 10-year implementation plan (AUC, 2015) has targets for industrial policy development (ECA, 2016b) for industrialisation hubs, for the African Mineral Development Centre (AMDC) and to promote the model law for regulating the African Pharmaceutical Industry.[69] The African Regional Report on the SDG's (ECA, AUC and AfDB, 2015) promoted an increase in manufacturing. In this regard it is noted that the AMDC has been transferred from UNECA to AUC in February 2019[70] and that the African Medicines Agency treaty has been adopted in May 2018.[71] The following targets are recommended based on the above.

Target	Timeline	Lead	Partners

[69] http://www.nepad.org/publication/african-union-au-model-law-medical-products-regulation
[70] https://www.uneca.org/stories/african-minerals-development-centre-moves-eca-african-union-commission
[71] https://au.int/en/pressreleases/20180520/african-union-ministers-health-adopt-treaty-establishment-african-medicines

Innovation and Entrepreneurship • Develop instruments, policies and programmes to support RECS in their work with member states to develop innovation and entrepreneurship, noting the following targets already stated or inferred within AU documentation and items provided as general guidance from the literature o That each country and regional economic community has a specific policy and plan to promote entrepreneurship within their STI Strategy; o That each country can demonstrate an increase in start-up companies in 2024, compared to 2014. o Share of manufacturing of GDP to reach 20% o Develop systems of innovation around key processes and products in the agricultural, industry and services sectors o Increase number of patents on innovative processes and products registered and applied over each half decade i.e. every 5 years o Hubs for industrialization / manufacturing linked to global value chains fully functional in all RECS by 2023 • African Mineral Development Centre (AMDC) to extend its footprint from 25 countries in 2018 to a substantively higher figure by 2023. • The first continental Pharmaceutical company is operational	Dec 2020 Dec 2023 Dec 2023	AUC-HRST AMDC PMPA	AUC, AUDA-NEPAD, UN, RECS, Development Banks, Development Partners Academia Professional bodies e.g. Engineers Private Sector Civil Society

4.1.8. Enabling Environment

152. There are number of platforms that are promoting dialogue in science, technology and innovation on the continent, such as the Senior Experts Dialogue (SED) championed by the ECA, the STI Forum championed by the AfDB, and the Africa Innovation Summit, among others. The main policy-relevant messages from these meetings should be captured and analysed so that they feed into our collective efforts in the implementation of STISA-2024.

Target	Timeline	Lead	Partners
Enabling environment • Develop instruments, policies and programmes to support RECS in their work with member states to develop an enabling environment for STI, noting the need to document ideas, concepts and consensus knowledge generated through appropriate expert meetings and summits and from literature review.	Dec 2020	AUC	UN, RECS, AUDA-NEPAD, Private Sector

General Guidance for Action

153. A large number of literature-based and consultation-based suggestions have been made in the area of this work stream on Research and Innovation. These suggestions are relevant to a number of STISA partners, including member states. It is beyond the remit and capabilities of this work plan to clearly define timelines for the delivery on these issues. They are listed to stimulate thinking and action around Research and Innovation on the continent. Several of these items are found within the literature listed in Section 1.8, They will ultimately require appropriate indicators to measure their progression, if implemented.

4.1.9. Infrastructure Development;

154. The following elements may be considered to promote infrastructure development.
    - Consolidate and expand Centres of Excellence and enhance institutional linkages in the continent.
    - Expand and upgrade TVET and polytechnics to attract quality trainees and provide incentives for career opportunities.
    - Establish Technology Transfer Offices to support Universities, and other institutions, to convert science and technological developments into innovative products.

- Consider the development of Technology Innovation Support Centres, with the support of WIPO[72] (WIPO, 2018).
- Promote Centres for the Development of Innovation, Entrepreneurship and Enterprise.
- Improve and expand internet access.
- Promote use of, and access to, digital libraries
- Leverage physical and digital infrastructure projects to build engineering capacity.
- Introduce measures to increase national and regional content of labour and materials.
- Establish and strengthen linkages with continental and global scientific and engineering communities.
- Embrace green approaches in infrastructure design and development.
- Share research facilities within regions and in the continent,
- Link regions with transport infrastructure to enhance mobility.
- Increase accessibility of scientific infrastructure for maximal use.

4.1.10. Technical Competences

155. The following elements may be considered to promote technical competences
    - Incorporate innovation and entrepreneurship concepts throughout the education system.
    - Promote partnerships between higher education, vocational training institutions and enterprises to jointly develop and implement relevant curricula and programs.
    - Strengthen engineering capacity.
    - Promote post-doctoral programmes and parallel track academic research career paths.
    - Promote in-country, in-region PhD scholarships.[73]
    - Promote innovative approaches to PhD training.[74]
    - Develop practical programmes and courses, including academic degree programmes and online programmes, to assist innovators and entrepreneurs (see for example programmes available at the Venture Capital for Africa site[75]).
    - Institutionalize internships as part of preparation for the world of work.
    - Consider providing tax and financial incentives for training institutions and private sectors involved in applying innovative solutions and promoting young entrepreneurs.
    - Promote lifelong learning, for example through online programmes.

[72] https://www.wipo.int/tisc/en/
[73] https://blog.ruforum.org/tag/scholarships/
[74] https://www.idea-phd.net/index.php/en/
[75] https://academy.vc4a.com/?_ga=2.75297108.715511550.1543276614-1681703712.1513868107

- Promote a strong Professional and Practitioners Regulatory System with appropriate Bodies in place and a data base available across AU Member States.
- Promote research on Innovation and Entrepreneurship.
- Promote international research and development cooperation based on continental interest and ownership.
- Promote ICT competence and literacy at all stages of the education system.
- Incentivise high profile STI diaspora members to contribute, lead and help build capacity

4.1.11. Innovation & Entrepreneurship

156. The following elements may be considered to promote innovation and entrepreneurship
    - Promote the establishment of Science Parks, technology hubs and incubators. The International Association of Science Parks[76] and other expertise developing on the continent may be able to provide assistance.
        - This requires linking to technology transfer and intellectual property issues outlined in section 4.2.1 and 4.2.4
    - Consider legislation that permits a university, small business, or non-profit institution to elect to pursue ownership of an invention arising from public sector funded research, similar in intention to the Bayh-Dohl Act in the USA.[77]
    - Encourage the establishment & expansion of financing instruments (e.g.. Seed Capital and Early Stage Venture funds).
    - Provide prizes and / or competitions for specific technical challenges e.g. South African Agency for Science and Technology Advancement (SAASTA) challenge to students and young people to design, build and race an electric car.[78]
    - Establish University Chairs in Science, Technology and Innovation.
    - Promote Human Resource mobility between industry and academia.
    - Promote Inclusive innovation.
    - Promote Green innovation.
    - Support the use of enabling technologies (e.g. ICT and nanotechnology).
    - Improve the measurement of innovation through access to relevant statistical information

[76] https://www.iasp.ws/
[77] https://en.wikipedia.org/wiki/Bayh%E2%80%93Dole_Act
[78] https://www.saasta.ac.za/greenpower-engineering-competition/

4.1.12. Enabling Environment

157. The following elements may be considered to promote an enabling environment
    - Support Member States and RECs to develop, implement and coordinate STI strategic plans and programmes.
    - Promote STI policy evaluation, reforms and harmonisation.
    - Strengthen IP regulatory environment.
    - Strengthen regulatory systems in general to ensure quality of research, manufacture and products.
    - Expand competitive grants and awards and other support mechanisms to nurture young academics and accomplished researchers.
    - Expand incentives, rewards and recognition programmes.
    - Mobilise resources for STI-led development.
    - Establish where necessary, and promote where they exist, National Academies of Science, both to build national scientific communities and to provide a voice for science to policy makers and the general public.
    - Engage academies for review and advice
    - Facilitate Industry / Academic linkages.
        - Create Government – Industry – Academic Councils in line with the triple helix model of innovation; or
        - Government-Industry-Academic-Social Entrepreneur Councils in line with the quadruple helix model of innovation.
    - Develop strategic national technology goals e.g Brazil's focus to develop ethanol production as a biofuel.[79]
    - Strengthen Labour Market Information Systems to identify skills and competencies needs.
    - Incorporate life skills development and career guidance throughout the educational system.
    - Provide incentives for training institutions and private sectors involved in applying innovative solutions and promoting young entrepreneurs.
    - Develop and utilise institutional, national and regional think tanks for the generation of ideas, strategies and policies.
    - Promote academic mobility e.g. intra-African travel for academics and academic and student exchange.[80]
    - Promote platforms for diaspora engagement.
    - Improve gender balance.
    - Promote and strengthen STI networks across the continent

[79] https://en.wikipedia.org/wiki/Ethanol_fuel_in_Brazil

[80] Not that this is facilitated by the development of a Pan African Quality Assurance and Accreditation Framework

5. Work Stream 4: Promoting STI Investment

Background

158. The STISA-2024 document highlights the need for 'Funding Mechanisms' to be put in place to support STISA. The concept of 'Promoting STI Investment' rather than developing funding mechanisms, is however preferred for this work plan. Investing in a strategy rather than funding a strategy, implies that there will be a return on that investment. The motivation of the investor, whether it be a Bank, a Government, an institution, a company or an individual, is that there is self-interest behind the provision of resources. It is critically important that Ministries of Finance, for example, view expenditure on R&D as an investment, as accepted by the UN System of National Accounts (UN, 2009) and not just as a recurrent expenditure. African institutions needs to recognise the power of a culture that invests in in STI as an integral part of a medium to long term strategy to ultimately stimulate economic growth,.

5.1.1. STISA-2024 directions for Strategy Funding / Investment

159. The STISA-2024 document highlights three major imperatives for financing STI. The first imperative is that member states are

> *"encouraged to allocate 1% of GDP to R&D so that Africa maximises ownership and responsibility for its own development path."*

The second imperative is that Member States and RECs are

> *"urged to streamline funding for STI, and entrepreneurship in their national development strategies and adapt existing STI polices to support implementation of STISA-2024",*

including the establishment of national and regional funds. The third imperative is to urgently

> *"set-up an African Science and Technology Innovation Fund (ASTIF) as a pan African financial instrument."*

The nature of the STI Fund is not discussed in detail. However, it is acknowledged that such a Fund, or resources in general for STISA, will require finance and funding from a wide variety of sources

5.1.2. Financing Tools and Mechanisms for STI in Africa

160. The major limitation on Science Technology and Innovation on the continent at the moment is financing, as highlighted in STISA-2024. While the European Union have a GERD target of 3% GDP, the African continent seeks to realise a target of 1%. The challenge for African countries to even achieve the level of 1% must be appreciated through the prism of how GERD is measured. GERD is a measure of expenditure sourced through: (i) Business Enterprise; (ii) Higher Education; (iii) Government; (iv) Private non-profit; and (v) Rest of the World, meaning funds received from outside the country for R&D. A significant amount of African country GERD comes

from ‘Rest of the World sources. It is important that Governments seek the right mix of the five categories of sources for R&D expenditure as well as the headline total figure.

161. There are several types of financing available.
    i. Finance can be made available as a grant, which is the classical way of financing academic research, whether sourced from within universities, from Governments or from not-for-profit organisations. This type of financing is utilised for most national research funds, the AU Research Grants Programme and AESA.
    ii. Finance can be made available as a loan, either at a micro level to a company, or at a macro level to a country, for example for the country to develop supportive infrastructure and other capabilities required for an enabling STI environment. At the macro level, the AfDB and World Bank financing of Higher Education in Africa has largely followed this approach
    iii. Finance can be made available as a capital investment, or equity stake. For example, venture capital investment in start-ups often follows this approach.

162. A major effort is under way, under the auspices of AESA, entitled the Coalition for African Research and Innovation (CARI).[81] According to its web site CARI

> *“aims to create a platform within Africa from which stakeholders can catalyze a highly coordinated, well-funded, innovative African R&D community together. ……. we expect that this conversation will yield commitments to work together in new ways to meet short-term health and development objectives while building long-term capacity in the field. This conversation will be led by Africans and guided by African concerns, and it will include African governments, African development organizations, the African private sector, African and global philanthropists, global funders, and industry.”*

Its leadership group comprises NEPAD, AAS, NIH, Wellcome Trust, Gates Foundation, German Ministry of Education and Research and representatives from the pharmaceutical industry.

163. The European Union also continues to partner with the African Union to invest in African STI. The European Union (2014) have also analyzed potential financing mechanisms for best practice support to regional and multi-country cooperative STI initiatives between Africa and Europe.

164. Several Governments have innovative Higher Education funding mechanisms in place, including the universities funds in Kenya, performance contracts in public universities in Senegal; Ghana Education

[81] https://aesa.ac.ke/cari/coalition-for-african-research-and-innovation/

Trust Fund (GETFUND) in Ghana and Tertiary Education Trust Fund (TETFUND) in Nigeria.

165. A major objective of STISA is the creation of an African STI Fund (ASTIF). However, the format and nature that such a fund will take is not clear. One option may be to follow the model of the African Education Fund, which is currently under discussion between the AfDB and the Association for Development of Education in Africa (ADEA), and for which a feasibility study has been undertaken.[82]

166. There is a strong case for such a fund to operate, at least in part, on borrowed money. The claim of STISA is that investment in STI will yield a measurable economic return on this investment. It is noted for example that, in the U.N. System of National Accounts, R&D is counted as investment (UN, 2009). This view was vindicated by the World Bank (2008) study demonstrating that investment in higher education leads to economic growth. It is further accepted by the major global economies, as shown by their drive to achieve competitive GERD levels, for example the 3% target of the European Union. If this is the case then borrowing resources now should pay for itself in the future. There should therefore be a way to negotiate substantive borrowing on reasonable terms in a way that both African countries, with AU support, and development banks, whose goal is the economic development of Africa, meet their desired objectives and achieve an overarching financing mechanism for continental STI.

167. As part of that negotiation, or independently, Governments may wish to take advantage of development bank financing windows to promote their national STI agendas. In this regard it is worth noting that African Development Fund (ADF)[83] which is the concessional window of the African Development Bank Group has its next round of Government financing programmes available from 2021. There is time for Governments to work with their national STI communities to plan ahead to access this financing. Other African Development Bank financial products may also be worth considering (African Development Bank, 2011).

168. Governments can provide financial incentives for Science, Technology and Innovation and associated research in two main ways, either through grants to research institutions, including potentially, industrial research centres, or through tax relief to companies wishing to undertake R&D. It should be realised that increasing grant expenditure limits the fiscal space for tax relief and tax relief limits the fiscal space for grant expenditure. In practice, tax relief to companies tends to support the downstream, late stage processes of innovation and may provide a more immediate return in terms of GDP.

[82] https://www.afdb.org/en/news-and-events/association-for-the-development-of-education-calls-for-establishment-of-african-education-fund-16982/

[83] https://www.afdb.org/en/about-us/corporate-information/african-development-fund-adf/about-the-adf/

Research grants support the earlier stages of innovation with a higher risk and longer period of return on the investment. The relative mix of grant funding versus tax relief will depend on the particular opportunities, goals and fiscal philosophy of a particular government. This issue is well discussed by (Guellec & Van Pottelsberghe De La Potterie, 2003)

169. A major cry from African scientists has been for African research to be supported by African resources. As mentioned above, much of the World Bank and AfDB financing can be categorised as Government expenditure. The Association of African Universities (2018) has put forward a number of recommendations related to the issue of providing African finance for STI related R&D, including the establishment of an African Higher Education Research Fund with an initial capitalization of $5 billion to support collaborative research by scholars from African institutions.

170. Other considerations and concepts for financing R&D have been put forward
    - Impact investing, whereby investment may lead to a social return rather than, or in addition to, a commercial return.[84]
    - Leveraging pension funds for financing infrastructure development in Africa (Sy, 2017)[85]

5.1.3. Structure of Work Stream 4

171. This introduction outlines some clear STISA-2024 priorities for action. These include the 1% GERD target as a percentage of GDP, the creation of ASTIF and the need to engage with RECS for the development of resource mobilisation strategies. Thereafter, the focus is on an overarching continental resource mobilisation strategy through ASRIC and the need to secure resources for AU Commission and AU agency functions, including the AU Research Grant Programme.

Work Stream Actions

5.1.4. Gross expenditure on R&D (GERD) as a proportion of GDP

172. The African Union, including through its Agenda 2063 10-year implementation plan, has set a target of 1% of GDP invested on R&D. Only three sub-Saharan African countries are close to this target: South Africa, Kenya and Senegal, around 0.8% in all three countries (UNESCO, 2017a). The ASRIC sub-committee on resource mobilization, based on an approach undertaken within the East African community, has proposed to develop a protocol that if approved would more strongly commit member states to reach the 1% target. The AU-C10 committee of Heads of State have

[84] https://en.wikipedia.org/wiki/Impact_investing
[85] This paper builds on an earlier background paper prepared in consultation with the U.N. Office of the Special Adviser on Africa for the Third United Nations Conference on Financing for Development, July 13-16, 2015, Addis Ababa, Ethiopia.

requested a study be undertaken to demonstrate to countries the value of investing in R&D.

Target	Timeline	Lead	Partners
Gross expenditure on R&D (GERD) as a proportion of GDP • Develop instruments, policies and programmes in strategic collaboration with RECS in their work with member states to move towards the 1% GERD target and generate a measurable increase in GERD as a proportion of GDP by 2024, compared to the initiation of STISA in 2014	Dec 2020	AUC	AU-C10, ASRIC, AUDA-NEPAD, UNESCO, UNECA, RECS, AfDB, Afreximbank, Development Partners, Academia Professional bodies e.g. Engineers Private Sector Civil Society
Supportive Actions to achieve 1% GERD • Utilize existing data on STI investment by Member States and develop a report on the comparative advantage in investing in R&D to ASRIC and the AU-C10 Heads of State	Dec 2019	AOSTI	

5.1.5. ASTIF

173. STISA-2024 states the need to set up an African Science Technology and Innovation Fund (ASTIF) as a pan-African financial instrument. The precise nature of this fund still needs to be worked out, given a large number of other financing efforts under way.

Target	Timeline	Lead	Partners
African Science Technology and Innovation fund (ASTIF) • African Science Technology and Innovation Fund (ASTIF) or its equivalent to be established	Dec 2023	AUC	AU-C10, ASRIC, AUDA-NEPAD, UNESCO, UNECA, RECS, AfDB, Afreximbank, Development Partners, Private Sector Member States

5.1.6. Engagement with RECs

174. There is a need for the AUC in general to work with RECs and Member States to align resource mobilisation priorities with their STI strategies and needs and, where possible, to support their national and regional resource mobilisation strategies. This will require a focal point in each REC and in each member state to facilitate these interactions. This work can be carried out in close consultation with the ASRIC Resource Mobilisation Committee.

Target	Timeline	Lead	Partners
Engagement with RECS • Develop instruments, policies and programmes to work with and support RECS in an attempt to align continental resource mobilization strategy with RECS and member state strategies, noting the role of the ASRIC Resource Mobilization Committee in supporting this effort and considering: ○ Establishment of focal point in each REC and in each member state on issues of resource mobilization for STI.	Dec 2019 with regular review Oct 2019	AUC	ASRIC, UN RECS, AUDA-NEPAD, AfDB, Afreximbank, Development Partners, Private Sector Member States

5.1.7. STISA Resource Mobilisation Strategy

175. There is a critical need to develop an overarching Resource Mobilisation Strategy for STISA aligned to the mandate of the ASRIC Resource Mobilisation Committee, namely:

> *"To mobilise financial and human resources to support research and STI programs in Africa in accordance with the AU policy in this area."*

This strategy will include the items already identified within this work stream plus a number of other actions identified by the ASRIC Resource Mobilisation Committee.

Target	Timeline	Lead	Partners

5.1.8. Sustainable Financing for AUC, AUDA-NEPAD and associated agencies

176. AUC and NEPAD/AUDA need to increase the level of funding they receive from African sources for their STISA-related activities.

Resource Mobilization Strategy for STISA • Resource mobilization Strategy commissioned and developed for STISA-2024, which may include the following elements, as developed by the ASRIC Resource Mobilization Committee o 1% GERD target o ASTIF o Engagement with RECS and Member States o Opportunities to partner with Development Banks o Flagship Programme financing o Identification and categorization of potential donors including: ▪ Individuals ▪ Philanthropies ▪ Private Sector Companies o Financing Incubators and Innovation hubs o Tax incentives o Scholarship and fellowship Schemes with a strong focus on promoting gender equality and providing opportunities for women o Intra-African Mobility and Exchange Schemes o Utilization of AU-C10 to facilitate resource mobilization o Engagement with Diaspora o Engagement with 'Friends of Africa' o Communications strategy for resource mobilization o M&E framework for monitoring effective use of resources	Oct 2019	AUC	AUC, AU-C10, AUDA-NEPAD, UNESCO, UNECA, RECS, AfDB, Afreximbank, Development Partners, Private Sector Academia Civil Society

Target	Timeline	Lead	Partners
Sustainable and increased financing of STI for AUC, AUDA-NEPAD and associated agencies • AUDA-NEPAD to develop targets and plans for their own self-financing from African sources for STISA-related activities. • AUC to develop targets and plans for their own self-financing from African sources for STISA-related activities.	Dec 2019 Dec 2019	AUDA-NEPAD AUCAUC	AUC, AUDA-NEPAD, AU-C10, RECS, Member States AfDB, Afreximbank, Private Sector Academia Civil Society

5.1.9. African Union Research Grant Programme

177. The most recent two rounds of the AU Research Grant Programme were managed by the AU Commission, with support from the European Union through a sum of 17.5 million euro under the EU Pan-African Programme. Two calls for research proposals in Africa were launched in 2016 and 2018. Nine institutions were awarded grants up to US$ 1,000,000 each in the 2016 Call for Proposals. For the 2018 call, eleven projects were selected totaling Euro 7 million. This African Union Research Grant Programme needs to be retained and further developed.

Target	Timeline	Lead	Partners
AU Research Grant Programme • AUC to further develop its African Union Research Grant Programme and at least maintain current level and frequency of funding till 2023.	Dec 2023	AUC-HRST	EU, AU-C10, RECS, Member States

6. Work Stream 5: STI Communication, Outreach and Advocacy

Background

178. The STISA-2024 document emphasises the need for a ‘Communication and Outreach Plan’. The ASRIC Committee on this topic has taken the title of ‘Communications, Outreach and Education’ to emphasise that ASRIC seeks to educate its target audiences on issues as it reaches out to them. However, some stakeholders outside ASRIC found the inclusion of ‘education’ in the title of a communications strategy confusing. Consultations undertaken in the development of this work plan indicated that the work stream should be entitled ‘Communications, Outreach and Advocacy.’

179. The STISA-2024 document highlights three major areas of activity for communications and outreach, namely: (i) Popularisation of STISA; (ii) Scientific Knowledge and Utilisation; and (iii) Awards and Prizes.

6.1.1. Popularisation of STISA

180. Popularisation of the strategy is targeted at two main audiences. The first is the internal audience of the stakeholders required to make decisions and implement STISA (see figure 1.3). These stakeholders include members of various African Union structures and related continental organisation such as the African Development Bank, the RECs and member states, as well as the academic and business communities and leaders, plus development partners. The second audience comprises the general public, with a special emphasis on the youth, who need to be made aware of the benefits of science, technology and innovation more broadly.

181. Within the youth, particular attention needs to be paid to young women and girls, who are under-represented in science and technology, engineering and mathematics as either students or teachers or practitioners. Gender-aware communications need to be mainstreamed within any communication approach to popularise STISA.

6.1.2. Scientific Knowledge and Utilisation

182. The STISA-2024 reference to Scientific Knowledge and Utilisation stresses the importance of the African STI community incorporating information provision and communication as a core component of its activities, including information on indigenous knowledge. Beyond the responsibility of individual scientists, technologists and innovators, and their host institutions to promote and explain their work, there is an obligation on national, regional and continental bodies to distil and make available our current levels of knowledge and their realistic potential for utility.

183. The lack of basic STI-related data at national, regional and continental level continues to be a major limitation for effective STISA communication. This links back to the lack of a STISA monitoring and evaluation framework and associated indicators. Those responsible for communication, outreach and advocacy need to work closely with those responsible for monitoring and evaluation and knowledge management i.e. AUC, AUDA-NEPAD and AOSTI, together with RECS and member states. Effective communication of information will be critical if it is to find utility.

184. It is important that scientific information and knowledge, together with other indicators of STI performance are made widely available if they are to be utilised to feed into national, regional and continental policy. It is also critical that such information is made available for the fundraising that will be required for investment in the further development of new information and knowledge. Investors require data to help them decide where, and how much, to invest, whether they be in the public or private sector.

6.1.3. Awards and Prizes

185. Awards and Prizes are an additional way of promoting science and rewarding scientific, technological and innovative endeavour. The African Union Kwame Nkrumah Awards for Scientific Excellence (AUKNASE)[86] are an example of a set of awards that could perhaps be expanded and further developed to promote STI on the continent. The awards are currently awarded at three levels: (i) continental level where two awards of USD 100,000 are given; (ii) regional level where two African women scientists per each of the five geographical regions of Africa receive USD 20,000 each; and (iii) national level, where two prizes are given per country to young scientists.

186. The growth of prizes for innovation and entrepreneurship by a number of organizations have already been outlined in section 5.1.3. It may be possible to work with one or more of the sponsoring organizations to better highlight some of the awards through the AU to highlight and promote the role of innovation and entrepreneurship on the continent.

6.1.4. STI Communication Architecture on the Continent. Current Limitations.

187. There are numerous avenues of communication relating to STISA, depending on the objectives of the communication, the originators of the communications and the stakeholders involved. These include:
    - Official AU, REC and member state documents
    - Formal commissioned reviews and analyses

[86] https://au.int/sites/default/files/announcements/34546-annc-2018_auknase_rules_of_procedure.pdf

- A vast array of scientific peer reviewed literature, which is the basis of our understanding of science today, complemented by patent literature describing innovations.
- Educational materials and programmes operating from early childhood education, through primary and secondary education to tertiary education. Some of these materials and programmes now span traditional national boundaries e.g. distance learning and online programmes, leading to both official qualifications and / or informal knowledge acquisition.
- The traditional journalistic media, whether in print, radio, television or online
- Institutional communications by organisations about their objectives, initiatives and the issues they promote and address
- Meetings and conferences to promote knowledge dissemination, discussion and action on a variety of issues, whether political, academic, business or socially directed.
- Social media and the creation and utilisation of both formalised, membership-based networks and informal networks, providing the potential to reach millions of people across nations, the continent and worldwide

188. Today, given the high level of competition for people's attention, through the formats above, a coherent, well-formulated communications strategy, with appropriate and effective messaging, is critical for the success of any activity. The more complex the issue and the stakeholder base, such as for STISA-2024, the more critical it is that a coherent and coordinated strategy is developed.

189. The preparation of this document, and its associated reference list and footnotes, illustrates the availability of information and documentation, much of it online, related to STISA. There are already multiple initiatives linked to STISA and STI in Africa generally, each actively promoting their institutions and their initiatives, whether they are academic, public sector oriented, civil society oriented or business oriented. It is in the interest of an effective STISA-2024 that these efforts should be expanded, their quality improved and their reach into society increased.

190. Some institutions, RECs and national governments have informative web sites, with useful documentation. However, many of the official AU, regional and governmental websites have very limited levels of quality information. Documents that should be publicly available are not readily available, or very difficult to locate. There is a need, especially for many African public sector institutions, to improve their web sites and quality of information dissemination.

191. There is a need for a more coherent and coordinated approach to communication of STISA, and STI in general on the continent. This call for coherence was highlighted to an extent within the strategic principles of this 5-year work plan (see Section 2) and requires a set of definitive actions. STISA-2024 states that

> *"AUC, NEPAD and Member State STI communication and outreach programs should utilize a coordinated, multichannel approach."*

STISA-2024 further notes that

> *"In Africa, the perceived relevance of STI research and innovation by wider society is weak."*

The establishment of ASRIC and its Committee on Communication, Outreach and Education provides an opportunity to help address this challenge from within the STISA-2024 architecture.

6.1.5. Structure of Work Stream 5

192. This introduction outlines some of the STISA-2024 priorities for action. The work stream focuses first on the need for regional and national communication strategies to be developed and then outlines some targets related to prizes. A substantive discussion STI Communications in Africa was undertaken by the Communications, Outreach and Education' of ASRIC and these inform a target for the development of an overarching STISA strategy.

Work Stream Actions

6.1.6. National and Regional Communication Strategies

193. In recent years, many countries and regional economic communities have developed STI policies and strategies, which should incorporate Communication and Outreach Activities. STISA-2024 states that

> *"AU Member States and RECs must cooperate in developing appropriate and mutually reinforcing national and regional plans for STI communication and outreach activities."*

Target	Timeline	Lead	Partners
National and Regional Communications Strategies • Develop instruments, policies and programmes to provide strategic collaboration and partnership with RECS in their work with member states such that every country and regional economic community has cooperated to develop and have in place appropriate and mutually reinforcing	Dec 2023	AUC	AUC, AU-C10, ASRIC, UN RECS, AfDB, Development Partners, Private Sector Academia

national and regional plans for STI Communication, Outreach and Advocacy as part of their overall STI strategies.			Civil Society

6.1.7. Awards and Prizes

194. There is potential to further develop science, innovation and entrepreneurship prizes on the continent to promote STI both within the academic and business community and to capture the imagination of the general public

Target	Timeline	Lead	Partners
Awards and Prizes • Maintain and seek to better promote and communicate the Kwame Nkrumah Awards for Scientific Excellence. o Explore how the awards might be enhanced to better promote STI on the continent • Explore options for AU to promote a prize for innovation and entrepreneurship	Annual May 2021 Jun 2020	AUC AUC AUC	AUC, EU, AU-C10, ASRIC, UN RECS, AfDB, Private Sector Academia Civil Society

6.1.8. Overarching Communication, Outreach and Advocacy Strategy for STISA

195. There is a critical need to develop an overarching Communications, Outreach and Education Strategy aligned to the mandate of the ASRIC Communications, Outreach and Education Committee, namely to develop a Communication Strategy to build/strengthen and sustain a continental research-policy nexus for ASRIC. Elements of such a communications strategy are included in the target below.

Target	Timeline	Lead	Partners
Overarching Communication, Outreach and Advocacy Strategy for STISA • Communications, Outreach and Education Strategy commissioned and developed for STISA-2024, which may include the following elements, as developed by the	Oct 2019	AUC	AUC, AUDA-NEPAD, AU-C10, UN

ASRIC Communications, Outreach and Education Committee: ○ Utilize C-10 Heads of State to advocate for STISA-related activities; ○ Create additional ASRIC Ambassadors who can help promote STI on the continent and can convey consistent messaging that clearly addresses the interests, concerns and previous exposure of target different constituencies and sectors. ○ Develop communication training programmes that will empower advocates for STI, including policy makers and decision makers, academia, civil society groups and members of the general public. ○ Engage with youth communities, to help them develop entrepreneurial opportunities leveraging STI through skills development training, linkages with education and research stakeholders, mentoring by private sector stakeholders and other structured support mechanisms. ○ Develop programmes with relevant institutions to help build STI capacity within the media e.g. promote science journalism courses. ○ Encourage communication of relevant and targeted information and dialogue with the public using local languages. ○ Regularly report progress and showcase local, national and regional achievements through case studies that have cross-border relevance and potential impact. ○ Identify target groups for communication • Scientists, Government officials • National Academies • National Research Councils • Beneficiaries-Local Communities and other, • Private sector/ Investors, • Sponsors,			RECS, AfDB, Devt. Partners, Private Sector Academic Civil Society

• Development Partners, • Stakeholders ○ Apply a variety of communication mechanisms • Traditional Media through; STI programs; Science for people; Science attractivity; and commercialization for youth • Africa Observatory for Science Technology and Innovation (AOSTI) • Social Media (Twitter, WhatsApp, Instagram, Facebook, mobile devices, etc.) • Advocacy/Lobbying through Civil Society Organizations • Radio, TV and newspapers • STI Forums, Seminars, Conferences, Open Days, Exhibitions, • Policy Briefs, Cabinet papers • STI Publications, open access sources • Web site, ASRIC Portal • Create African STI high quality reviews in the priority areas ○ Provide information on: • Research results • Congress resolutions • Best practices • Innovation / Technology • Funding / Financial Information • Exchange and Collaboration opportunities (strategic partnerships) • Success stories • Private Sector Priorities • Countries National priorities and capabilities • STI Forums, Seminars, Conferences, Open Days, Exhibitions, • Policy Briefs, Cabinet papers • STI Publications, open access sources			

○ Create a special initiative relating to Public Private Partnership to: • Provide guidance on how to create and negotiate Partnerships with Private and Public Sectors • Identify Ambassadors to promote public Private Partnerships ○ Create an ASRIC web site and portal for easy access to information on STISA and STI-related activities. • In addition to primary material generated specifically for the ASRIC web site, the portal can direct any interested parties to partner web sites that contain the primary information of interest. • The ASRIC portal could become a useful one-stop shop for gaining up to date information on STISA and STI-related information, activities, organisations and initiatives, including information on funding and investment opportunities. • Such a portal could reinforce information provided by the other partner and stakeholder institutions of STISA, such as: AUC, AUDA-NRPAD and AOSTI. ○ Provide a mapping tool to track STI activities ○ Liaise with media houses to encourage the popularisation of science and technology e.g. through articles, radio and TV programmes, plus promote ○ Publication of an annual STISA report ○ Publication of a STISA Newsletter ○ Promote prizes that already exist throughout the continent, and encourage additional prizes for African Science, Research, Innovation and Entrepreneurship ○ Promote continental and international ranking systems for: STI, including Global Innovation Index, World University Rankings etc.			

Reflections on STISA Governance and Management

Background

196. This work plan has as its ultimate goal the promotion and facilitation of action on the ground at country level. In this regard it has stressed the importance of initiatives that have developed outside the STISA architecture, but are nevertheless aligned to STISA and are operating in support of STISA. Examples include AESA, CARI and the numerous innovation and entrepreneurship awards and prizes, self-coordinating groups and technology hubs that have developed within the last several years.

197. This action on the ground benefits tremendously from a coherent strategic vision coming from the apex of African Union, RECS and Member States. This is currently manifest in Agenda 2063 and the Sustainable Development Goals, which have mobilised the continental and international community. It is noteworthy that a number of substantive changes in the organisation of the African Union are currently under way to improve how the AU, and the AUC, together with AUDA-NEPAD, can best serve the people of Africa.

198. With these thoughts in mind, this final section focuses on some aspects of the STISA architecture and how its Governance and Management might be enhanced. These suggestions are minimal as the proposed STISA Foresight 2063 process outlined in work stream 1 should take a more detailed look at the STISA's Governance Architecture.

199. Two main ideas are put forward. First, the need to clearly assign responsibilities for tasks within the work plan to specific agencies so that there is a reduced risk of time slippage of major objectives. Second, to build on the idea of a Think Tank for STISA, following on from the request by the AU-C10 Heads of State that a Think Tank be established to assist them in their work.

Assigning responsibilities within STISA

200. By its nature, the network of partners and activities undertaken within STISA needs to be 'loose-knit'. Many activities will start independently of each other and run independently of each other and succeed independently of each other. The overall goal of STISA is increased STI activity on the continent and that can best be generated from stimulating and facilitating activities and ideas as they are generated, rather than seeking to control them, or impose unnecessary restrictive processes. The mesh that loosely binds the network together should primarily consist of an information flow, for example on what is happening from a policy, technical and business

perspective, and on opportunities available for financing. This information should be widely available within society, especially today in the age of social media and social networking.

201. However, there is a major caveat to this. Within this loose-knit network, the centre, the core, that holds STISA together and which has generated the STISA concept, is the AU and the many agencies and institutions, operating within the STISA architecture outlined in Figure 1.3. There needs to be clarity on the roles and functions of these agencies and institutions for the delivery of the work plan targets. For this reason, only one lead agency has been identified for each target. This approach is not unusual for a large and disparate strategic initiative such as STISA, where individual activities require collaboration between many institutions and individuals both inside and outside the AU. Failure of clear lines of responsibility can lead to inefficiency and delays in achieving work plan targets.

202. As we look to develop better communication strategies, we also need to assess how and through which part of the STISA architecture should certain types of information be communicated. Who has the final editorial approval for certain documentation for example? Getting these issues addressed at the work plan stage, the monitoring and evaluation stage, and the implementation plan stage will pay dividends later on with respect to promoting AU leadership for STI across the continent.

A potential role for a Think tank or Top-Level Advisory Group

203. One of the decisions made by the AU-C10 Heads of State at the First Extra-Ordinary Summit for the Committee of Ten Heads of State and Government (AU-C10) championing Education, Science and Technology, held on 2nd–3rd November in Lilongwe, was to create a think tank of eminent individuals from across Africa and the diaspora to assist them in their task of taking forward Education, Science and Technology in Africa.

204. It may be that such a group could play a broader role within STISA. The work of the AU-C10 Heads of State needs to be fully aligned with STISA. If there is variance in the messages coming from the AU-C10 and the main STISA strategy then this could be a source of confusion. One option is that the ‘Think Tank’ could double-up as an ‘Advisory Group’ to STISA as a whole. This might be managed, for example, by an annual meeting of the Think Tank / Advisory Group, where they are presented with top-level documentation and progress reports by key informants and can provide guidance and advice, and perhaps generate some new ideas and insights on how best to proceed.

205. The composition of such a Think Tank or Advisory Group is critical. It needs to be multi-disciplinary and span multiple sectors, but also needs to be small enough to allow for detailed interactive discussion. A group of 8 to 12 people would probably be optimal. The most important element of the group is the quality of the individuals. They should be eminent people in their own right and be renowned for their achievements to date and their innovative, and independent, thinking. They should not be selected because of their current position, though there should ideally be a gender, age and geographic balance. It may be useful that such a group has a strong interface with the APET high-level panel on emerging technologies. The following areas of expertise to be covered by the Think Tank / Top-level Advisory Group is proposed to stimulate thought and discussion on the issue.
    - Education, including Higher Education
    - Technical and Vocational Education and Training
    - Science, Technology, Engineering and Innovation to cover, among other issues
        - Environment, Agriculture, Health, ICT
        - Construction and Planning
    - Business
    - Trade and Industry
    - Finance and Investment
    - Entrepreneurship, including for Small and Medium Enterprises
    - Policy

Concluding Remarks

206. Much has been accomplished since STISA-2024 was launched in June 2014. Several new agencies and institutions have been officially launched e.g. AOSTI and ASRIC, and the existence of STISA has been quite well publicised and is known within the continental science and research community and among continental and international partners. The creation of STISA alone has helped stimulate activity in several priority areas, for example through Ruforum helping coordinate higher education institutional research in the pursuance of Priority Area 1 and the launch of the World Bank financed Strengthening Higher Agricultural Education in Africa Programme.

207. The launch of STISA-2024 has also coincided with enhanced opportunities for Development Bank loans to countries to promote higher education research capacity and centres of excellence, and a growth in continental science funding opportunities e.g. through AESA and the Africa Union research grant programme. Many countries and regional economic communities have revised, or are revising their STI strategies. In addition, there has been a substantial growth in technology and innovation hubs across the continent and a growing interest in promoting entrepreneurship and supporting small business development.

208. These activities have been underpinned by the continued continental support for Agenda 2063 and African integration. This is reflected through a number of large-scale projects for infrastructure development across Africa through PIDA, through the commitment to create a continental free trade area across Africa (CFTA) and through ambitious technical projects such as the establishment of a Space Strategy for Africa.

209. However, much needs to be done. The base level of Science, Technology, Engineering and Innovation infrastructure and human resource capacity in Africa is low by global standards. This remains the case for Science, Technology, Engineering and Innovation funding and financing and for measurable STI outputs, for example low levels of scientific publications, patents and innovative business development. STISA, if well executed, can help generate resources and activity to address these limitations. It can lead to enhanced infrastructure and competence development and the delivery of innovation for industrial growth through a series of strong, coherent, strategies and accompanying implementation plans over the coming decades that have a wide stakeholder engagement. These plans need to grounded in the needs of the Regional Economic Communities and Member States. They also need to be aligned to the development priorities of Agenda 2063, in particular the technical requirements of integration through infrastructure development and the growth of industry and trade across the continent.

210. STISA provides an opportunity to help coordinate the vast array of STI stakeholders towards a common vision of a prosperous and scientifically and technically competitive continent. The quality of leadership of the AUC and its associated agencies and partners, and the material and financial support received from within the continent will be critical to STISA's success.

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APPENDIX. Matrix Illustrating Work Plan

Work Stream	Title
1	Strategy Development and Monitoring and Evaluation
2	Policy and Institutional Interventions
3	Research and Innovation
4	Promoting STI Investment
5	Communication, Outreach and Advocacy

WP Section	Work Stream 1; Strategy Development and Monitoring and Evaluation Target	Timeline	Lead Agency	Key Partners
3.2.1	**STISA-2024 M&E framework and implementation plan** **M&E Framework** • Approved gender-responsive STISA-2024 M&E Framework with relevant indicators that has been generated with involvement of key stakeholders, notably RECS, seeking alignment with regional and frameworks. • A harmonised mechanism, supported by AOSTI, ASRIC and AUDA that will support Member States and RECs to collect standardised data. **Implementation Plan** • Approved gender-responsive STISA-2024 implementation plan, using indicators from M&E Framework that has been generated with involvement of key stakeholders, notably RECS, seeking alignment with regional and national plans. • Annual reports on implementation plan progress with audited revision of targets and / or timelines as necessary, based on data acquisition. **Link to Africa Innovation Outlook** • Data driven by the M&E framework to inform Africa Innovation Outlook 2022.	Dec 2019 Ongoing Dec 2019 Ongoing Dec 2021	AOSTI AOSTI AUDA-NEPAD AUDA-NEPAD AUDA-NEPAD	RECS, Member States, UN, AUC-HRST, AUDA-NEPAD, ASRIC, AOSTI, AfDB, Private Sector, Academia. Professional bodies e.g. Engineers, Civil Society
3.2.2	**STISA 2063 Strategic Foresight** • Approved gender-responsive Strategic Foresight (STISA Foresight 2063) aligned to Agenda 2063, undertaken through a consultative process involving experts and key stakeholders, including RECS, that includes include top-level direction for intermediate 10-year strategies leading up to 2063. ○ Intermediate Target of initiation	Jun 2022 Jun 2019	AUC-HRST	

3.2.2	**STISA-2034 with M&E framework and implementation plan** **Strategy** • Approved gender-responsive STISA-2034 Strategy undertaken through a consultative process involving experts and key stakeholders, including RECS, seeking alignment with regional and national plans, o Intermediate target of Initiation **M&E Framework** • Approved gender-responsive STISA-2034 M&E framework undertaken through a consultative process involving experts and key stakeholders, including RECS, seeking alignment with regional and national plans o Intermediate target of Initiation **Implementation Plan** • Approved gender-responsive STISA-2034 implementation plan, undertaken through a consultative process involving experts and key stakeholders, including RECS, seeking alignment with regional and national plans, and that incorporates plans for a mid-term review. Intermediate targets are: o Intermediate target of Initiation	Jun 2024 Jun 2022 Jun 2024 Jun 2022 Jun 2024 Jun 2022	AUC-HRST AOSTI AUDA-NEPAD	
3.2.3	**STISA-2024 End of Term Review** • Approved End of Term STISA-2024 Review Report undertaken through a consultative process involving experts and key stakeholders, including RECS, and to take into account African Innovation Outlook 2022. Intermediate targets are : o Intermediate target of Initiation	Jun 2024 Jan 2022	AUC-HRST	

WP Section	Work Stream 2; Policy and Institutional Interventions Target	Timeline	Lead Agency	Partner Agencies
4.2.1	**ASRIC** • ASRIC to become fully operational in 2019 and to hold annual meetings of ASRIC Congress.	Nov annually	ASRIC Secretariat	AUC-HRST, RECS, UN, AUDA-NEPAD, AfDB, Private Sector, Professional bodies e.g. Engineers, Academia, Civil Society
4.2.2	**Flagship Programmes** • At least one round of flagship programmes selected and operational in each priority area. by 2023.	Dec 2023	ASRIC	
4.2.3	**PAIPO** • PAIPO is established and fully functional by 2023	Dec 2023	AUC-HRST	RECS, UN, AUDA, ARIPO, OAPI
4.2.4	**Pan African Quality Assurance and Accreditation Framework**			
	• Expedite ratification of the Addis Convention	Ongoing	AUC	UNESCO, Member States
	• Initiate the development of African Qualification Frameworks including TVET	Jun 2019	AUC	RECS, EU, GIZ, UNESCO, ILO, ADEA, CAPA
	• Operationalize the establishment of the Continental Quality Assurance and Accreditation Agency	Dec 2019	AUC	AAU, EU, UNESCO, National / Regional agencies
	• At least 50% Member States have national accreditation systems in place	Dec 2023	Member States	AUC, UNESCO

WP Section	Work Stream 2; Policy and Institutional Interventions Target	Timeline	Lead Agency	Partner Agencies
4.2.5	**Pan African University** • Pan African University consolidated with at least 25 satellite centres	Dec 2023	PAU	AUC UNESCO RECS, Member States
4.2.6	**Africa Virtual and E-Learning University** • Support the development of the Africa Virtual and E-Learning University under the PAU and annually document the following, including for STEM and STI-related programmes o increased number of programmes o increased number of students enrolled o Increased number of students graduating	Annual	PAU	AUC. RECS UNESCO, Member States AAU
4.2.7	**Pan-African Institute for Statistics** • The Pan African Institute of Statistics is fully functional by 2023	Dec 2023	AUC-DEA	EU, UNESCO, RECS, National Statistics Offices
4.2.8	**Think Tank of African Expertise to Support the AU-C10** • Establish a Think Tank to support the AU Committee of Ten Heads of State and Government (AU-C10), Championing Education, Science and Technology in Africa o Prepare a Terms of Reference for C-10 Task Force / Advisory Group o Identify and appoint members of the Task Force / Advisory Group o Convene a first annual meeting of the Task Force / Advisory Group	Sep 2019 Apr 2019 Jun 2019 Sep 2019	AUC-HRST	RECS, UN, AUDA-NEPAD, ASRIC, AAS, AfDB, Private Sector, Civil Society, Academia, Professional bodies e.g. Engineers.

WP Section	Work Stream 2; Policy and Institutional Interventions Target	Timeline	Lead Agency	Partner Agencies
4.2.9	**Regional and National Frameworks for Actions on STI** • Establish instruments to provide strategic collaboration and partnership with RECS, such that each Regional Economic Community has in place an up to date gender responsive STI policy, strategy, M&E framework and implementation plan (or their equivalents) with appropriate indicators and targets taking into account short term, medium term and long-term priorities, that are internally coherent and consistent and incorporate strong innovation components, as well as S&T, and cascading this approach to member states.,	Dec 2023	AUC-HRST	RECs, UN, AUDA-NEPAD, ASRIC, AOSTI, Private Sector, Academia, Professional bodies e.g. Engineers, Civil Society, Member States
4.3	**Interventions Linked to the Six Priority Areas** • Establish instruments to facilitate engagement between the central STISA policy and implementing bodies (AUC, AUDA, ASRIC) and the lead stakeholder communities and agencies engaged in all six priority areas, namely: 1. Eradication of hunger and achieving food security; 2. Prevention and Control of Diseases; 3. Communication (Physical and Intellectual Mobility); 4. Protect our Space; 5. Live together – build the society; and 6. Wealth Creation, such that the instruments facilitate the mobilisation of relevant actors to recognise, support and actively engage in STISA and STISA-relevant activities. ○ That in so doing, full account is taken of other programmes and plans established by the AU relating to Science and Technology such as the CAADP; AADP, PIDA; AIDA; PMPA; and the African Space Strategy; and ○ That where there is no strong identifiable overarching community or body available to cover the priority area, such as in Priority Areas 5 and 6, the central STISA bodies coordinate and develop the necessary	Dec 2019	AUC-STRC	RECS, Member States, UN, AUC-HRST, AUDA-NEPAD, ASRIC, AOSTI, AfDB, Sectoral Stakeholders Private Sector, Academia, Professional bodies e.g. Engineers, Civil Society

WP Section	Work Stream 2; Policy and Institutional Interventions Target	Timeline	Lead Agency	Partner Agencies
	structures, linkages and communities for the development of functional instruments of engagement.			
	Partnership with UN agencies			

4.4.2	**Regional Coordinating Mechanism (RCM)**
	• Establish STISA with high visibility and priority within the RCM draft work plan, noting:
	  ○ The relevance of STISA to the Cluster 3 on Human capital development, health, nutrition, science, technology and innovation; especially Sub-Clusters on Science and Technology and on Education and Human resources
	  ○ The large number of UN agencies, joint working groups and mechanisms e.g. Joint UN Technology Facilitation Mechanism, that may be taken advantage of by STISA through AU-UN coordination
		Jan 2020	UNESCO	AUC, AUDA-NEPAD UN

	Partnership with Private Sector			
4.4.3	**Pan-African Trade and Investment Committee (PAFTRAC)** • Develop a functional interface with PAFTRAC so that the inclusion of Industry, Trade and Investment components are mainstreamed within STISA	Dec 2019	AUC-HRST	AUC-EA, AUC-DTI, PAFTRAC, Private Sector AUDA-NEPAD, ASRIC

WP Section	Work Stream 2; Policy and Institutional Interventions Target	Timeline	Lead Agency	Partner Agencies
4.4.3	**Private Sector Forum** • STISA is formally represented and makes a presentation at each Private Sector Forum, supported by side meetings to strengthen the Private Sector interface.	Annually	AUC-HRST	Private Sector Forum, AUDA-NEPAD, ASRIC

WP Section	Work Stream 3; Research and Innovation Target	Timeline	Lead Agency	Partner Agencies
5.2.1	**<u>Infrastructure Development</u>** • Develop instruments, policies and programmes to support RECS in their work with member states to develop STI infrastructure, including engineering infrastructure, noting the following targets already stated or inferred within AU documentation and items provided as general guidance from the literature o Standards of at least one science and technology university in each African country be raised to benchmarked world-class standard in training and research by 2020 o Establish at least three world-class centres of excellence in science, technology and innovations in each African country by 2030 to drive innovations and the application of new knowledge in agriculture, industry and services o Resource and upgrade NEPAD Centres of Excellence in biosciences, water sciences, laser technology, mathematical sciences, among others, to attain global standards by 2025 o Increased public sector investment in STI and research infrastructure including laboratories and institutes in 2024 compared to 2014; o Increased private sector investment in STI and research infrastructure including laboratories and institutes in 2024 compared to 2014; and. o Increased public-private partnerships in higher education and research infrastructure development in 2024 compared to 2014	Dec 2020	AUC-HRST	AUC-DIE, AUDA-NEPAD, UN, RECS, Development Banks, Development Partners Academia Professional bodies e.g. Engineers Private Sector Civil Society
5.3.1	**General guidance for Member State Action on Infrastructure Development with no definitive targets** o Consolidate and expand Centres of Excellence and enhance institutional linkages in the continent. o Expand and upgrade TVET and polytechnics to attract quality trainees and provide incentives for career opportunities. o Establish Technology Transfer Offices to support Universities, and other institutions, to convert science and technological developments into innovative products.		AUC-HRST	RECS, AUC, AUDA-NEPAD, UN, Development Banks, Development Partners Academia

WP Section	Work Stream 3; Research and Innovation Target	Timeline	Lead Agency	Partner Agencies
	○ Consider the development of Technology Innovation Support Centres, with the support of WIPO (WIPO, 2018). ○ Promote Centres for the Development of Innovation, Entrepreneurship and Enterprise. ○ Improve and expand internet access. ○ Promote use of, and access to, digital libraries ○ Leverage physical and digital infrastructure projects to build engineering capacity. ○ Introduce measures to increase national and regional content of labour and materials. ○ Establish and strengthen linkages with continental and global scientific and engineering communities. ○ Embrace green approaches in infrastructure design and development. ○ Share research facilities within regions and in the continent, ○ Link regions with transport infrastructure to enhance mobility. ○ Increase accessibility of scientific infrastructure for maximal use.			Professional bodies e.g. Engineers Private Sector Civil Society
5.2.2	**Technical Competences** • Develop instruments, policies and programmes to support RECS in their work with member states to develop technical competences, including engineering competences, noting the following targets already stated or inferred within AU documentation and items provided as general guidance from the literature **PhD training** ○ That countries demonstrate an increase in STEM PhD programmes and students in 2024 compared to 2014: ○ Train at least 1000 highly qualified scientists (PhD) annually on the continent ○ To commit a special fund(s) to facilitate the training of female university members of staff and women in general to PhD level in support Agenda 2063 vision of quality education and gender equality.	Dec 2020	AUC-HRST	AUC, UN, RECS, member States, Development Banks, ADEA, AAU, CAMA, Development Partners Academia Professional bodies e.g. Engineers

WP Section	Work Stream 3; Research and Innovation Target	Timeline	Lead Agency	Partner Agencies
	Post-secondary education targets, including TVET ○ Increase numbers of qualified teachers with focus on STEM by 30% ○ Universal secondary school enrolment of 100% ○ 30% secondary school leavers progress to tertiary education with 40% being female ○ 70% of school leavers not progressing to tertiary education are provided with options for further TVET skills development			Private Sector Civil Society
5.3.2	**General guidance for Member State Action on Technical Competences with no definitive targets** ○ Incorporate innovation and entrepreneurship concepts throughout the education system. ○ Promote partnerships between higher education, vocational training institutions and enterprises to jointly develop and implement relevant curricula and programs. ○ Strengthen engineering capacity. ○ Promote post-doctoral programmes and parallel track academic research career paths. ○ Promote in-country, in-region PhD scholarships.[87] ○ Promote innovative approaches to PhD training.[88] ○ Develop practical programmes and courses, including academic degree programmes and online programmes, to assist innovators and entrepreneurs (see for example programmes available at the Venture Capital for Africa site[89]). ○ Institutionalize internships as part of preparation for the world of work. ○ Consider providing tax and financial incentives for training institutions and private sectors involved in applying innovative solutions and promoting young entrepreneurs.		AUC-HRST	AUC, UN, RECS, member States, Development Banks, ADEA, AAU, CAMA, Development Partners Academia Professional bodies e.g. Engineers Private Sector Civil Society

[87] https://blog.ruforum.org/tag/scholarships/
[88] https://www.idea-phd.net/index.php/en/
[89] https://academy.vc4a.com/?_ga=2.75297108.715511550.1543276614-1681703712.1513868107

WP Section	Work Stream 3; Research and Innovation Target	Timeline	Lead Agency	Partner Agencies
	○ Promote lifelong learning, for example through online programmes. ○ Promote a strong Professional and Practitioners Regulatory System with appropriate Bodies in place and a data base available across AU Member States. ○ Promote research on Innovation and Entrepreneurship. ○ Promote international research and development cooperation based on continental interest and ownership. ○ Promote ICT competence and literacy at all stages of the education system. ○ Incentivise high profile STI diaspora members to contribute, lead and help build capacity ○ Promote the availability of Open Distance and e-Learning Programmes and online programmes			
5.2.3	**Innovation and Entrepreneurship** • Develop instruments, policies and programmes to support RECS in their work with member states to develop innovation and entrepreneurship, noting the following targets already stated or inferred within AU documentation and items provided as general guidance from the literature ○ That each country and regional economic community has a specific policy and plan to promote entrepreneurship within their STI Strategy; ○ That each country can demonstrate an increase in start-up companies in 2024, compared to 2014. ○ Share of manufacturing of GDP to reach 20% ○ Develop systems of innovation around key processes and products in the agricultural, industry and services sectors ○ Increase number of patents on innovative processes and products registered and applied over each half decade i.e. every 5 years ○ Hubs for industrialization / manufacturing linked to global value chains fully functional in all RECS by 2023	Dec 2020	AUC-HRST	AUC, UN, RECS, Development Banks, Development Partners Academia Professional bodies e.g. Engineers Private Sector Civil Society

WP Section	Work Stream 3; Research and Innovation Target	Timeline	Lead Agency	Partner Agencies
	• African Mineral Development Centre (AMDC) to extend its footprint from 25 countries in 2018 to a substantively higher figure by 2023. • The first continental Pharmaceutical company is operational	Dec 2023 Dec 2023	AMDC PMPA	
5.3.3	**General guidance for Member State Action on Innovation and Entrepreneurship with no definitive targets** o Promote the establishment of Science Parks, technology hubs and incubators. The International Association of Science Parks and other expertise developing on the continent may be able to provide assistance. o This requires linking to technology transfer and intellectual property issues outlined in section 4.2.1 and 4.2.4 o Consider legislation that permits a university, small business, or non-profit institution to elect to pursue ownership of an invention arising from public sector funded research, similar in intention to the Bayh-Dohl Act in the USA. o Encourage the establishment & expansion of financing instruments (e.g. Seed Capital and Early Stage Venture funds). o Provide prizes and / or competitions for specific technical challenges e.g. South African Agency for Science and Technology Advancement (SAASTA) challenge to students and young people to design, build and race an electric car. o Establish University Chairs in Science, Technology and Innovation. o Promote Human Resource mobility between industry and academia. o Promote Inclusive innovation. o Promote Green innovation. o Support the use of enabling technologies (e.g. ICT and nanotechnology). o Improve the measurement of innovation through access to relevant statistical information		AUC-HRST	AUC, UN, RECS, Development Banks, Development Partners Academia Professional bodies e.g. Engineers Private Sector Civil Society

WP Section	Work Stream 3; Research and Innovation Target	Timeline	Lead Agency	Partner Agencies
5.2.4	**Enabling environment** • Develop instruments, policies and programmes to support RECS in their work with member states to develop an enabling environment for STI, noting the need to document ideas, concepts and consensus knowledge. generated through appropriate expert meetings and summits and from literature review.	Dec 2020	AUC	AUC, UN, RECS, Development Banks, Development Partners Academia Professional bodies e.g. Engineers Private Sector Civil Society
5.3.4	**General guidance for Member State Action on Enabling Environment with no definitive targets** o Promote STI policy evaluation, reforms and harmonisation. o Strengthen IP regulatory environment o Strengthen regulatory systems to ensure quality of research, manufacture and products. o Expand competitive grants and awards and other support mechanisms to nurture young academics and accomplished researchers. o Expand incentives, rewards and recognition programmes o Mobilise resources for STI-led development o Establish where necessary, and promote where they exist, National Academies of Science, both to build national scientific communities and to provide a voice for science to policy makers and the general public. o Engage academies for review and advice o Facilitate Industry / Academic linkages. o Create Government – Industry – Academic Councils in line with the triple helix model of innovation; or o Government-Industry-Academic-Social Entrepreneur Councils in line with the quadruple helix model of innovation. o Develop strategic national technology goals e.g Brazil's focus to develop ethanol production as a biofuel. o Strengthen Labour Market Information Systems to identify skills and competencies needs.			

WP Section	Work Stream 3; Research and Innovation Target	Timeline	Lead Agency	Partner Agencies
	○ Incorporate life skills development and career guidance throughout the educational system. ○ Provide incentives for training institutions and private sectors involved in applying innovative solutions and promoting young entrepreneurs. ○ Develop and utilise institutional, national and regional think tanks for the generation of ideas, strategies and policies. ○ Promote academic mobility e.g. intra-African travel for academics and academic and student exchange. ○ Promote platforms for diaspora engagement. ○ Improve gender balance.			

WP Section	Work Stream 4; Promoting STI Investment Target	Timeline	Lead Agency	Partner Agencies
6.2.1	**<u>Gross expenditure on R&D (GERD) as a proportion of GDP</u>** • Develop instruments, policies and programmes in strategic collaboration with RECS in their work with member states to move towards the 1% GERD target and generate a measurable increase in GERD as a proportion of GDP by 2024, compared to the initiation of STISA in 2014 **Supportive Actions to achieve 1% GERD** • Utilize existing data on STI investment by Member States and develop a report on the comparative advantage in investing in R&D to ASRIC and the AU-C10 Heads of State	Dec 2020 Dec 2019	AUC AOSTI	AUC, AU-C10, ASRIC, AUDA-NEPAD, UNESCO, UNECA, RECS, AfDB, Afreximbank, Development Partners, Academia Professional bodies e.g. Engineers Private Sector Civil Society
6.2.2	**<u>African Science Technology and Innovation fund (ASTIF)</u>** • African Science Technology and Innovation Fund (ASTIF) or its equivalent to be established	Dec 2023	AUC	ASRIC, AU-C10, AUDA-NEPAD, UNESCO, UNECA, RECS, AfDB, Afreximbank, Development Partners, Private Sector
6.2.3	**<u>Engagement with RECS</u>** • Develop instruments, policies and programmes to work with and support RECS in an attempt to align continental resource mobilization strategy with	Dec 2019 with	AUC	ASRIC, UN RECS, AUDA-

WP Section	Work Stream 4; Promoting STI Investment Target	Timeline	Lead Agency	Partner Agencies
	RECS and member state strategies, noting the role of the ASRIC Resource Mobilization Committee in supporting this effort and considering ○ Establishment of focal point in each REC and in each member state on issues of resource mobilization for STI.	regular review Oct 2019		NEPAD, AfDB, Afreximbank, Development Partners, Private Sector Member States
6.2.4	**<u>Resource Mobilization Strategy for STISA</u>** • Resource mobilization Strategy commissioned and developed for STISA-2024, which may include the following elements, as developed by the ASRIC Resource Mobilization Committee ○ 1% GERD target ○ ASTIF ○ Engagement with RECS and Member States ○ Opportunities to partner with Development Banks ○ Flagship Programme financing ○ Identification and categorization of potential donors including: ▪ Individuals ▪ Philanthropies ▪ Private Sector Companies ○ Financing Incubators and Innovation hubs ○ Tax incentives ○ Scholarship and fellowship Schemes with a strong focus on promoting gender equality and providing opportunities for women ○ Intra-African Mobility and Exchange Schemes ○ Utilization of AU-C10 to facilitate resource mobilization ○ Engagement with Diaspora ○ Engagement with 'Friends of Africa' ○ Communications strategy for resource mobilization	Oct 2019	AUC	ASRIC, AU-C10, AUDA-NEPAD, UNESCO, UNECA, RECS, AfDB, Afreximbank, Development Partners, Private Sector Academic Civil Society

WP Section	Work Stream 4; Promoting STI Investment Target	Timeline	Lead Agency	Partner Agencies
	○ M&E framework for monitoring effective use of resources			
6.2.5	**<u>Sustainable and increased financing of STI for AUC, AUDA-NEPAD and associated agencies</u>** • AUDA-NEPAD to develop targets and plans for their own self-financing from African sources for STISA-related activities. • AUC to develop targets and plans for their own self-financing from African sources for STISA-related activities.	Dec 2019 Dec 2019	AUDA-NEPAD AUC	AUC, AUDA-NEPAD, AU-C10, RECS, Member States AfDB, Afreximbank, Private Sector
6.2.6	**<u>AU Research Grant Programme</u>** • AUC to further develop its African Union Research Grant Programme and at least maintain current level and frequency of funding till 2023.	Dec 2023	AUC-HRST	EU, AU-C10, RECS, Member States

WP Section	Work Stream 5; Communication, Outreach and Advocacy Target	Timeline	Lead Agency	Partner Agencies
7.2.1	**National and Regional Communications Strategies** • Develop instruments, policies and programmes to provide strategic collaboration and partnership with RECS in their work with member states such that every country and regional economic community has cooperated to develop and have in place appropriate and mutually reinforcing national and regional plans for STI Communication, Outreach and Advocacy as part of their overall STI strategies.	Dec 2023	AUC	AU-C10, ASRIC, UN RECS, AfDB, Development Partners, Private Sector
7.2.2	**Awards and Prizes** • Maintain and seek to better promote and communicate the Kwame Nkrumah Awards for Scientific Excellence. o Explore how the awards might be enhanced to better promote STI on the continent • Explore options for AU to promote a prize for innovation and entrepreneurship	Annual May 2021 Jun 2020	AUC AUC AUC	EU, AU-C10, ASRIC, UN RECS, AfDB, Private Sector
7.2.1	**Overarching Communication, Outreach and Advocacy Strategy for STISA** • Communications, Outreach and Education Strategy commissioned and developed for STISA-2024, which may include the following elements, as developed by the ASRIC Communications, Outreach and Education Committee: o Utilize C-10 Heads of State to advocate for STISA-related activities; o Create additional ASRIC Ambassadors who can help promote STI on the continent and can convey consistent messaging that clearly addresses the interests, concerns and previous exposure of target different constituencies and sectors. o Develop communication training programmes that will empower advocates for STI, including policy makers and decision makers, academia, civil society groups and members of the general public.	Oct 2019	AUC	AUC, AU-C10, ASRIC, UNESCO, UNECA, RECS, AfDB, Afreximbank, Development Partners, Academia Professional bodies e.g. Engineers Private Sector Civil Society

WP Section	Work Stream 5; Communication, Outreach and Advocacy Target	Timeline	Lead Agency	Partner Agencies
	○ Engage with youth communities, to help them develop entrepreneurial opportunities leveraging STI through skills development training, linkages with education and research stakeholders, mentoring by private sector stakeholders and other structured support mechanisms. ○ Develop programmes with relevant institutions to help build STI capacity within the media e.g. promote science journalism courses. ○ Encourage communication of relevant and targeted information and dialogue with the public using local languages. ○ Regularly report progress and showcase local, national and regional achievements through case studies that have cross-border relevance and potential impact. ○ Identify target groups for communication • Scientists, Government officials • National Academies • National Research Councils • Beneficiaries-Local Communities and other, • Private sector/ Investors, • Sponsors, • Development Partners, • Stakeholders ○ Apply a variety of communication mechanisms • Traditional Media through; STI programs; Science for people; Science attractivity; and commercialization for youth • Africa Observatory for Science Technology and Innovation (AOSTI) • Social Media (Twitter, WhatsApp, Instagram, Facebook, mobile devices, etc.)			

WP Section	Work Stream 5; Communication, Outreach and Advocacy Target	Timeline	Lead Agency	Partner Agencies
	• Advocacy/Lobbying through Civil Society Organizations • Radio, TV and newspapers • STI Forums, Seminars, Conferences, Open Days, Exhibitions, • Policy Briefs, Cabinet papers • STI Publications, open access sources • Web site, ASRIC Portal o Provide information on: • Research results • Congress resolutions • Best practices • Innovation / Technology • Funding / Financial Information • Exchange and Collaboration opportunities (strategic partnerships) • Success stories • Private Sector Priorities • Countries National priorities and capabilities • STI Forums, Seminars, Conferences, Open Days, Exhibitions, • Policy Briefs, Cabinet papers • STI Publications, open access sources o Create a special initiative relating to Public Private Partnership to • Provide guidance on how to create and negotiate Partnerships with Private and Public Sectors • Identify Ambassadors to promote public Private Partnerships o Creation of an ASRIC web site and portal for easy access to information on STISA and STI-related activities should be a top priority.			

WP Section	Work Stream 5; Communication, Outreach and Advocacy Target	Timeline	Lead Agency	Partner Agencies
	• In addition to primary material generated specifically for the ASRIC web site, the portal can direct any interested parties to partner web sites that contain the primary information of interest. • The ASRIC portal could become a useful one-stop shop for gaining up to date information on STISA and STI-related information, activities, organisations and initiatives, including information on funding and investment opportunities. • Such a portal could reinforce information provided by the other partner and stakeholder institutions of STISA, such as: AUC, AUDA-NEPAD and AOSTI. ○ Provide a mapping tool to track STI activities ○ Liaise with media houses to encourage the popularisation of science and technology e.g. through articles, radio and TV programmes, plus promote ○ Publication of an annual STISA report ○ Publication of a STISA Newsletter ○ Promote prizes that already exist throughout the continent, and encourage additional prizes for African Science, Research, Innovation and Entrepreneurship ○ Promote continental and international ranking systems for: STI, including Global Innovation Index, World University Rankings etc.			