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GREEN
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AFRICAN UNION GREEN INNOVATION FRAMEWORK

TRANSFORMING AFRICA'S SUSTAINABLE DEVELOPMENT PROSPECTS

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This study was commissioned by the African Union Scientific, Technical and Research Commission and it reflects the views and opinions expressed therein, which are not necessary those of the AU and its Commission. This study was developed with the aim to improve and strengthen science, technology and innovation capacities at the national, regional and continental levels through building and upgrading research infrastructures, enhancing professional and technical competencies, promoting innovation and entrepreneurship development and creating an enabling environment for STI and ultimately to assist Member States and RECs to adopt /domesticate STISA-2024.

Executive Summary

This report articulates an African Union Green Innovation Framework (AU-GIF) which is intended to guide African Union Member States towards a path of economic prosperity through sustainable technological, industrial and system innovations. The Framework aims to galvanise the efforts of and between African countries to enhance societal and economic resilience to environmental pressures, promote a greater efficient use of natural resources and achieve the aspirations of Agenda 2063 and the Sustainable Development Goals as envisioned by the United Nations.

In the face of an unprecedented degree of environmental pressure exemplified by climate change, an acceleration of biodiversity loss, land degradation, water shortage, and air pollution, the world is now increasingly looking to make a transition from traditional exploitative development models towards the green economy. A green economy is defined as one that achieves improved human well-being and social equity, while also significantly reducing environmental risks and ecological scarcities, and one which is low-carbon, resource-efficient and socially inclusive (UNEP 2011).

The green economy is imperative for Africa's development, prosperity, resilience, and livelihood. Despite negligible contribution to the global stock of greenhouse gas emissions, Africa is the continent most vulnerable to climate change. At the same time, much of Africa's economic growth remains resource intensive, relying excessively on the extraction of finite natural resources. Africa's population is growing at a rate that will increase pressure on natural resource use and exacerbate poverty if no action is taken to address this trend. Moreover, the world is witnessing a transition to a global green economy evidenced, for example, by the growth of electric cars and renewable energy technologies. Global green growth transition presents opportunities for the African continent in terms of creation of green jobs, poverty reduction, supporting sustainable growth, restoring environmental health, and promoting climate and environmental resilience. Furthermore, the green economy offers a potential channel for delivering inclusive economic development in Africa while managing the social, economic, and environmental consequences associated with 'business as usual' approaches to development both in the continent and globally.

A transition to the green economy is almost impossible without innovation. Africa's global competitiveness in the future decades depends very much on innovation in general and green innovation in particular. Innovation is a core requirement for improving Africa's economic productivity while reducing its dependence on natural resource exploitation. Innovation is significantly important to create agricultural practices that are resilient to climate change and enhance African economies' ability to add value to their natural resources. Green innovation is required for Africa to gain a global competitive advantage by harnessing its abundant renewable resources and aiming to become a net exporter of renewable energy and related energy technologies. In key sectors such as agriculture, transport, health, industry, and tourism, innovation in product and production, marketing and organisation processes is central to positioning Africa to effectively participate and benefit from the global greening, conservation, and sustainability.

The African Union has duly recognised the central role of innovation in driving the continents' quest for sustainable development and has formulated the first decade incremental strategy on innovation – the AU Science, Technology and Innovation Strategy for Africa 2024 *(STISA-2024)* to help accelerate Africa's transition to an innovation-led knowledge economy. Already a number of African countries have elaborated national frameworks to help promote innovation. However, a quick search shows that many are yet to properly and adequately articulate a robust framework for promoting green innovations in their jurisdictions.

This report, enunciates an African Union Green Innovation Framework 2030 (AU-GIF) intended to facilitate the mobilization of the power of innovation to manage Africa's vulnerability to current and future environmental pressures and accelerate economic growth and development on a low-carbon path in the pursuit of sustainable development.

The proposed Green Innovation Framework for Africa (AU-GIF) has four core principles. The first, stresses the need to link Africa's Green Innovation systems with the Science, Technology and Innovation Strategy for Africa, STISA-2024. Secondly, the AU-GIF is anchored on the National Innovation Systems (NIS) of AU member states, many of which have already invested to various degrees in developing national science, technology and innovation roadmaps. The first and second principles are vital for creating synergies between green innovation systems and the wider national and continental science, technology and innovation strategies needed to propel economic development and prosperity throughout Africa. Thirdly, the Framework is premised on the principle that Africa's green innovation approach must be targeted at meeting Africa's development challenges. Linking Green Innovation to Agenda 2063, National Determined Contributions (NDCs) and SDGs may provide opportunities for harnessing green innovation in response to articulated national development objectives in the context of a global sustainable development agenda. African's green innovation approach must also have transformative tendencies of agility, adaptability and far-sightedness. While being responsive to current challenges and trends, there is a need for futuristic thinking and long-term scenarios to cushion the continent from sluggish development in a rapidly changing world. Fourth, previous experiences indicate the importance of moving from emergency, short-term, reactive approaches towards long-term systematic approaches underpinned by a clear vision, strong processes and a commitment to continual improvement.

The report has identified values, attitudes and social norms; knowledge systems; skills and technology systems; as well as national innovation policies and strategies as the four pillars of the AU-GIF2030. While national innovation systems of AU member states will serve as a base for the operationalization of a continent wide green innovation revolution, it is proposed that the various national innovation systems are connected to the regional and continental innovation strategies through virtual centres of excellence, knowledge sharing platforms, multilateral and bilateral research and development programmes and other initiatives designed to enhance co-production of knowledge and joint learning among member states. Developing and implementing robust and successful innovation in Africa will also require the cultivation of strategic bi-lateral and multi-lateral partnerships within the continent as well with international development partners.

The report also identifies conducive institutional frameworks, long-term investment strategies, finance windows/opportunities, as key enablers for effective green innovation in Africa. Africa has a unique advantage in being a 'latecomer to industrialization', which offers opportunities for experimentation which also helps the continent avoid problems such as system lock-in that continues to be experienced by highly industrialized nations. However, the lack of robust technology infrastructure, skilled workforce and robust knowledge generation systems especially in higher education systems enhances the continent's vulnerability and presents a momentous threat to innovation which requires a well thought-out sustained strategy. It is therefore anticipated that the AU-GIF will provide the roadmap for a green innovation driven development approach in Africa.

Forward

The African Union Green Innovation Framework comes at an opportune time when the continent is faced with strategic economic social and environmental opportunities. Africa is currently a promising global development frontier due to its rich and unexploited natural resource base, a rapidly increasing population and relatively low carbon footprints. African countries have demonstrated through grassroot innovations, indigenous knowledge systems, science and entrepreneurship that innovation is central to the stability of its socio-economic systems and global competitiveness. Indeed, the Africa's Agenda 2063 'The Africa We Want' envisages home grown innovation as a pathway to sustainable industrialised economies. The STISA 2024 additionally emphasise the role of Africa-driven knowledge systems as central in building sustainable industrialised economies.

Africa's transition to sustainable industrialisation faces complex contextual and global challenges. Emerging pandemics such as Ebola and others posit unprecedented emergencies and uncertainties to the continent's social and economic systems. In addition, Africa still remains vulnerable to existing risks such as climate change and associated disasters- floods, drought, fires among others. Climate change models predict that 350-600 million people in Sub-Saharan Africa will be affected by water stress creating additional challenges of food insecurity, diseases and economic impacts such as job losses. Climate risks for the continent is pronounced by the fact that over 70% of the African population live in dry lands and other fragile ecosystems but on the hand, have very limited capacity to adapt to the expected impacts. The continent's economic dependence on agricultural activities that are directly linked to climatic factors increases vulnerability thus the need for rethinking innovative pathways to non-farm livelihood options.

Efforts to address these challenges exist globally and within the continent i.e. through climate funding, technology support as well as green growth investments. However, Africa is yet to fully tap into these opportunities. Tapping into these opportunities would require the continent to move from business as usual to more innovative technological and social and ecological solutions that enhances the continents global competitiveness. The African Union Green Innovation Framework (AU-GIF) provides a broad-base guide and rationale for the African Union Member States towards a path of economic prosperity through sustainable technological, industrial and system innovations.

The Framework specifically brings multiple benefits to the continent. First, it provides a rationale and a guide on the need to innovate for the realisation of the broad sustainable development in Africa through catalysing green growth as envisaged by the many African Member States. The framework steers African countries to actualize and fast track short-term economic recovery with long-term green transition and sustainable

industrialisation. Second, the framework seeks to spur green technological and social innovations that will enhance the competitiveness of the continent to build and tap into various opportunities such as green financial opportunities e.g. the Green Climate Fund, create green jobs, spur green investments and market competitiveness within the continent and globally and to exploit the great potential for synergies between economic prosperity, social justice and environmental sustainability. Building on opportunities such as The African Continental Free Trade Agreement (AfCFTA), the AU-GIF provides a means to developing important manufacturing and trade links that are aligned to the sustainable development trajectory. Third, the AU-GIF is a key governance tools for collective – continent-wide coordination and lesson sharing on green growth. Such sharing and collective governance will promote resource pooling, peer support and scaled up impacts.

Ultimately, it's worth recognising that developing such a robust framework is a good thing but implementing it is even better. To this end, the delivery of this framework will depend on the commitments from the Member States, institutional support as well as political goodwill, to enable and mobilize collective actions from a diversity of stakeholders including donors, regional economic bodies, the scientific community, community-based organisations and even the civil society. Such collective actions will help drive the various pillars of the AU-GIF to beneficial outcomes in line with the Africa Agenda 2063 'The Africa We Want'.

Acknowledgments

This work was born out of contention as green innovation is now centre piece in development. The need for green innovation is driven by concern for quality of life and resource security in the African continent as well as securing a clean and green image as a means to attract investment for sustainable growth and high quality jobs, earth preservation, food security, and solution to other global agenda. It is driven by concern for realizing a low-carbon, recycling, and nature-conscious society as well as an effective policy to reduce Green House Gas emission.

There are lot of bright minds working on futuristic projects that promised to make the wold greener while making entrepreneurs some green. Green technology and innovation encompass continuously evolving group of methods and material from techniques for generating non-toxic clean product and services that in turn protects, preserves the environment.

Since, the development of the Science Technology and Innovation Strategy for Africa 2014-2024 (STISA-2024) that emphasis green innovation as panacea for solving many challenges and that provides Africa's niche in catching up with the rest of the world in technological front. The African Union, Scientific, Technical and Research Commission (AU-STRC) under its Environmental, Climate Change and Green programmes and activities have studied and discussed issues of green innovation in the continents.

AU-STRC selected environmentalist and green technology experts in the continent likes of Prof. Salah Solimon, Dr. Geoge Mwaniki, Dr. Sabine Stuart-Hill, Dr. Yeruna Peter Tarfa among other discuss and analyse the concept of African Union Green Innovation Framework (AU-GIF). There are several brainstorming and experts meeting that took before and during the development of the framework.

The AU-STRC appreciates and thanks the Commissioner Human Resources Science and Technology H. E Prof. Sarah Anyang Agbor for supports and guidance received from her on the activities and programme of environment. We also appreciate the unrelenting effort of the Team Leader of the experts and consultant that produced this framework Dr. Joanes Atela, Prof. Godwell Nhamo, Dr. Chukwumerije Okereke, and Vuyo Mjimba to study, for devoting their time and energy in the production of the framework despite their numerous other schedules.

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Table of Contents

EXECUTIVE SUMMARY I

FORWARD V

ACKNOWLEDGMENTS VII

LIST OF FIGURES XI

LIST OF TABLES XIII

LIST OF ABBREVIATIONS XV

CHAPTER 1: INTRODUCTION 1

1.1 AFRICA ON THE PATH OF CLIMATE CHANGE 1

1.2 GREEN INNOVATION FOR AFRICA 3

1.3. GREEN INNOVATION IN THE CONTEXT OF AFRICA 6

1.3.1. DEFINING GREEN INNOVATION 6

1.3.2. LINKING GREEN INNOVATION TO OTHER RELEVANT CONCEPTS/IDEAS 7

1.4. RATIONALE FOR THE AU-GIF 8

1.4.1 INNOVATING FOR SUSTAINABLE DEVELOPMENT IN AFRICA 9

1.4.2. TAPPING INTO THE GREEN INNOVATION OPPORTUNITIES 9

1.4.3 A PLATFORM FOR GREEN GROWTH COORDINATION AND LESSON SHARING 11

CHAPTER 2: SITUATIONAL ANALYSIS 13

2.1. POLICY LANDSCAPE 13

2.1.1. GREEN INNOVATIONS AND THE SDGS 13

2.1.2 GREEN INNOVATION AND THE PARIS AGREEMENT 14

2.1.3. GREEN INNOVATION AND THE AGENDA 2063 15

2.1.4. GREEN INNOVATIONS AND THE STISA 2024 15

2.1.5. GREEN INNOVATIONS AND OTHER AFRICA'S DEVELOPMENTAL FRAMEWORKS 16

2.1.6. GREEN INNOVATION AND RECS 17

2.1.7 GREEN INNOVATION AND NATIONAL GREEN GROWTH STRATEGIES 18

2.1.8. GREEN INNOVATION OPTIONS 19

2.2. FINANCIAL AND TECHNICAL LANDSCAPE 19

2.3. MARKET LANDSCAPE 20

2.4 STAKEHOLDER LANDSCAPE 21

CHAPTER 3: CORE PRINCIPLES OF THE AFRICAN UNION GREEN INNOVATION FRAMEWORK (AU-GIF) 23

3.1. ANCHORING AU-GIF WITH STISA- 2024 23

3.2 ANCHORING AU-GIF ON THE NATIONAL INNOVATION SYSTEMS 24

3.3. ANCHORING AU-GIF TO THE NATIONAL DEVELOPMENT AGENDAS 25

3.4. ANCHORING AU-GIF ON A LONG-TERM VISION 25

CHAPTER 4: PILLARS OF THE AU-GIF 27

4.1. TECHNOLOGY SYSTEMS AND SKILLS 28

4.2. KNOWLEDGE SYSTEMS 31

4.3. PEOPLE AND SOCIETY 34

4.4. REGIONAL/NATIONAL INSTITUTIONAL AND POLICY ENABLERS 36

4.5. GREEN INNOVATION FUND 39

CHAPTER 5: IMPLEMENTATION PLAN FOR THE AU-GIF 41

PEOPLE AND SOCIETY 45

CHAPTER 6: ENABLERS FOR THE IMPLEMENTATION PLAN 51

5.1. SPECIALIZED IMPLEMENTATION COMMITTEES 51

5.2. RESOURCE MOBILIZATION AND SUPPORT 52

5.2.1. FINANCIAL RESOURCES 52

5.2.2. HUMAN RESOURCES 53

5.2.3. INFRASTRUCTURAL RESOURCES 53

5.3. STAKEHOLDER ENGAGEMENT AND ADVOCACY 54

5.4. MONITORING EVALUATION AND LEARNING SYSTEM 54

REFERENCES 57

GLOSSARY 61

ANNEX 1 63

List of Figures

Figure 1. Carbon Dioxide Emissions per Capita 1
Figure 2: Decline of the surface area of the Lake Chad from 1963 to 2007 2
Figure 3: Pathways to green innovations.....8
Figure 4: GCF Allocation per sector and per region: Equal allocation of the Fund to both Mitigation Adaptation. Out of the Adaption allocations 50% will be channelled to LDCs, SIDS and Africa 10
Figure 5: Policy setting for green innovations in Africa 14
Figure 6. The building structure of STISA 2024.....17
Figure 7: The AU-GIF Core Principles 23
Figure 8: Pillars of the Africa Union Green Innovation Framework 2030 (AU-GIF) ...28
Figure 9: Schematic presentation of green technology system for the AU-GIF 29
Figure 10: A framework for effective knowledge systems that can promote green innovation in Africa. Source: HLP 32
Figure 11: AU GIF implementation enablers 51

List of Tables

Table 1: AU-GIF Implementation Plan 43
Table 2: Options for mobilising the AU-GIF resources 52

List of Abbreviations

AfCFTA:	African Continental Free Trade Agreement
AFDB:	Africa Development Bank
AU:	African Union
AUC:	African Union Commission
CDM:	Clean Development Mechanism
COMESA:	Common Market for East and Central Africa
COP:	Conference of Parties
DNA:	Designated National Authority
EAC:	East African Community
ES:	Environmental Service
GI:	Green Innovation
GIF:	Green Innovation Framework
HLP:	High Level Panel
ICDP:	Integrated Conservation and Development Project
IGAD:	Intergovernmental Authority on Development
IPCC:	Intergovernmental Panel on Climate Change
NDC:	Nationally Determined Contributions
NRM:	Natural Resource Management
PES:	Payments for Ecosystem Services
RECs:	Regional Economic Communities
REDD+:	Reducing Emissions from Deforestation and Degradation plus the role of conservation, sustainable forest management and carbon enhancement
SADC:	Southern Africa Development Community
SBSTA:	Subsidiary Body for Scientific and Technical Advice
SDGs:	Sustainable Development Goals
STISA:	Science Technology and Innovation for Africa
AU-STRC:	African Union Scientific Technical and Research Commission
UN:	United Nations
UNDP:	United Nations Development Programme
UNFCCC:	United Nations Convention on Climate Change

Chapter 1: Introduction

1.1 Africa on the Path of Climate Change

It is widely accepted that both natural and human activities are responsible for the Earth's climate change. Before the industrial era the change in the Earth's climate resulted entirely from natural causes such as Earth's orbit, changes in solar activities and/or volcanic eruptions. Since the industrial era began, humans have had an increasing effect on climate, particularly by adding billions of tons of heat-trapping greenhouse gases to the atmosphere. The reality is that most of the observed warming since the mid-20th century is due to human caused greenhouse gas emissions.

African Union, Scientific, Technical Research and Commission publication, shows Africa contributes less than 4% of the total CO_2 emissions globally which is a precursor to climate change. While most of the African countries are producing less than 1 ton/capita, the developed world average is more than 10 ton/capita as shown[1] in Figure 1. The publication shows that USA produces 17.1 while China produces 6.1 ton/capita, recognizably the report shows that AU Member States are producing within an average range of less than 1 ton/capita.

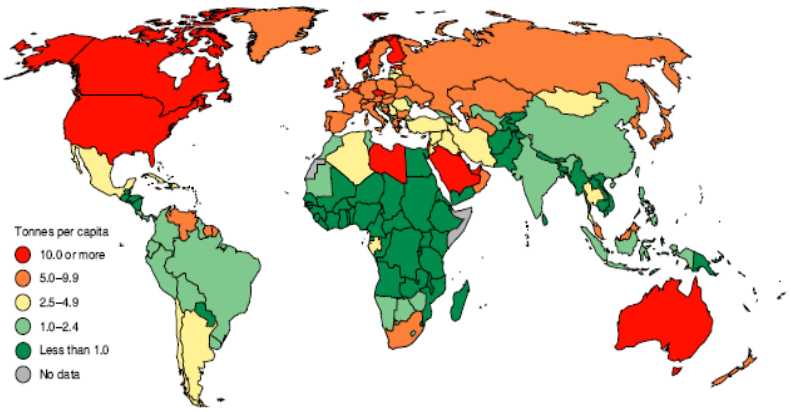

Figure 1. Carbon Dioxide Emissions per Capita

Despite the meagre contribution of Africa to the climate change, it remains the most vulnerable part of the world at risk to the impact of climate change. The consequences of climate change are now affecting the ecosystems and biodiversity conservation in the continent. The projections of climate change based on modeling scenarios, suggest trends towards warmer conditions for the 7 inland subtropics, with frequent occurrences of extreme heat, increasing aridity and changes in rainfall patterns. This situation is exacerbated by modest economic development and low adaptive capacity in most of the countries in the region. The impact of climate change on Africa is likely to be severe because of adverse direct effects, high dependence on rainfed agriculture, and limited capacity to adapt.

Climate change models show that water stress will increase particularly in North Africa but also putting 350-600 million more people in Sub-Saharan Africa at the risk of water stress. This is evident if we consider the continued decline of the surface area of the

[1] World Bank (2008) World development report agriculture for development. World Bank, Washington DC

Lake Chad where it shrunk from 22,902 km2 in 1963 to 3,042 km2 in 2001 as shown[2] in Figure 2. During the 20th century, the aerial extent of Mt. Kilimanjaro's ice cap decreased by about 80 %. It has been suggested that if current climatological conditions persist, the remaining ice cap are likely to disappear between 2015 and 2020[3].

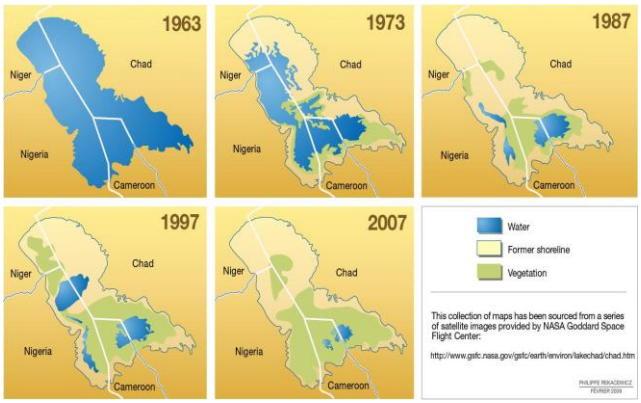

Figure 2: Decline of the surface area of the Lake Chad from 1963 to 2007

In 2015 FAO reported that over 70% of the African population live in dry lands and other fragile ecosystems across the continent. Population growth and increasing climate change impact puts pressure on these ecosystems, exacerbating degradation and desertification of increasingly over exploited lands[4]. It is estimated that 35% of the total land area of Ghana is prone to desertification and these areas prone to desertification/drought have almost doubled in the last two decades. In Ethiopia, approximately 70% of the total land area and 80% of those in Kenya are reported to be prone to desertification in recent years[5]. According to the UN Nigeria is losing 1,355 square miles of cropland and rangeland due to desertification each year. This problem affects each of the 11 states of northern Nigeria. Nigeria loses approximately 320,000-350,000 hectares of land per year, which causes mass displacement of local communities in its Northern region. The frustration is not limited to the Member States mentioned above but it is also extended to others.

But climate conditions such as extreme temperature, excessive rainfall and floods, desertification and drought complicate these challenges and affect the key determinant of survival and health including water, food, shelter and air. In Ethiopia and Kenya, children aged 5 or less were respectively 36% and 50% more likely to be malnourished if they were born during a drought year. In Niger, children aged 2 or less born in a drought year were 72% more likely to be stunted or short for their age – a sign of

[2] UNEP (2008) Analyzing environmental trends using satellite data: selected cases. Environmental Change Analysis Series. DEW/0598/NA

[3] Thompson L G E, Mosely-Thompson M E, Davis K A, Henderson H H, Beecher V S, Zagorodnov T A, Mashiotta P, Lin V N, Mikhalenko D, Hardy R and Beer J (2002) Kilimanjaro ice core records: Evidence of Holocene climate change in tropical Africa. Science 298:589–93

[4] Food and Agriculture Organization (2014) EU and FAO step up action against desertification in Africa, Caribbean and Pacific. http://www.fao.org/news/story/en/item/261498/icode/.

[5] Africa Progress Report (2014) Grain fish money: financing Africa's green and blue revolutions. Africa Progress Panel, Geneva. www.africaprogresspanel.org.

malnutrition which have direct or indirect link with the impact of climate change[6]. The effect of other diseases such as malaria and tuberculosis which are already severe will be amplified. Women will be disproportionately affected, and life expectancy already reduced to 40-years in some countries.

Against the above challenges from climate change along with other challenges, there is need for Africa to go green based on concern for quality of life and resource security (including water). In addition, securing a clean and green infrastructure is a means to attract investment for sustainable growth and high-quality jobs, Earth preservation, food security, and solution to other global agenda. These approaches are driven by concern for realizing a low-carbon economy and promoting values for a nature-conscious society through sustainable production and consumption practices. According to World Sustainable Development Conference if societies are to become sustainable, they will need to go green to exploit the great potential for synergies between economic prosperity, social justice and environmental sustainability. Since the beginning of the 21st century, to cope with a series of global problems such as climate change and the global financial crisis, promoting a transition to a green economy has become a worldwide trend.

Therefore, there is need to actualize and fast track short-term economic recovery with long-term green transition and sustainable development through technological, industrial and system innovation, so as to achieve multiple objectives, including creating new industries and job opportunities, establishing competitive advantages, safeguarding resources security and dealing with environmental pollution and climate change. Hence, the development of the AU-GIF is to take Africa to economic prosperity and low carbon society.

1.2 Green Innovation for Africa

The need for innovative solutions to environmental, social and economic challenges and opportunities facing Africa is increasingly becoming apparent. Innovation is a necessity because of the multitude of challenges facing the continent currently which are increasingly becoming complex, dynamic and inter-linked. As alluded to earlier, the continent is already experiencing unprecedented challenges imposed by climate change, population growth, natural resource depletion, as well as the need to address persistent widespread poverty. Over the past few years, African countries have embraced **green economy** as a means of addressing the complex environmental and economic challenges.

Green economy refers to an economy that reduces environmental risks and ecological scarcities, through low carbon, resource efficient actions aligned to sustainable development without degrading the environment. While green economy is the most commonly used term in the policy discourse of most African countries, this framework refers more to **Green growth** which simply entails a green economy that is not static but that which is growing/increasing over time and space meeting the needs of people and reducing poverty. To this extent green growth here entails fostering economic

[6] UNDP (2007) Human Development Report, Fighting climate change: human solidarity in a divided world. http://hdr.undp.org/sites/default/files/de_la_fuente_alejandro_2007b.pdf.

growth and development while significantly reducing environmental risks and ensuring that natural assets continue to provide the resources and environmental services for development.

The global climate change policy supports green growth as a low-carbon, resource-efficient and socially inclusive pathway with significant potential for delivering mitigation and adaptation ambitions for the continent.[7] Globally, green growth is considered as critical for achieving the 2030 Agenda for Sustainable Development and the accompanying 17 sustainable development goals, the SDGs[8].

For Africa, the pursuit for a green growth has several benefits some of which include: helping Africa to build resilience to climate shocks; achieve resource efficiency and reduce dependence on natural resource exploitation; providing the needs of people, other species; achieve social and environmental justice; reduction in carbon footprints; creates equality of life for everyone including future generations; and ensuring biodiversity conservation.

In addition to these it avails opportunities to tap into global climate and clean-tech finance while also increasing economic competitive advantage by harnessing their abundant renewable resources. To exploit these opportunities, it is crucial that Africa to consider–innovation at the centre of its development approach as the identified and future development challenges will inevitably dictate the need to devise new and innovative products, processes, organizations and approaches for managing risks and pursuing economic development and growth at individual, regional and continental levels. The urgency to deliver within the specified time limits elevates the need for an innovation-driven economic development and growth approach. The central role of innovation in driving Africa's development agenda is recognised in several forums.

Innovation is identified as essential to achieving Africa's prosperity objective as articulated in every aspiration of the Agenda 2063 *'The Africa We Want'*[9], and its subsidiary policies. Similarly, African Union's (AU) Science Technology and Innovation Strategy for Africa *(STISA-2024)* recognises the importance of science, technology and innovation to the continent's sustainable growth.[10] The *STISA 2024* policy analysis highlighted the need to maximize on the benefits of green technologies and innovations in Africa. The strategy's emphasis is that the continent should participate actively in the green economy by leveraging on the opportunities of new industrial era of wealth creation and development. The analysis also called for the development of policies and systems geared towards turning resource constraints and climate crisis into economic opportunities that generate double dividends (increasing growth with reduced environmental impact) by improving investments in natural capital and enhancing resource efficiency[11].

Facilitating Green Growth in Africa requires innovation that catalyses linkages between environment and development while addressing new tractable challenges such as

[7] UNEP (2011), UNFCCC (2015)
[8] United Nations, UN, (2015).
[9] AUC, (2014)
[10] AUC, (2015)
[11] African Economy Driven by Innovation "Policy analysis on STISA 2024" (AU-STRC 2016)

climate change and poverty.[12] The AU Climate Change Strategy seeks to address the adaptive capacities and resilience of AU Members States and Regional Economic Communities (RECs) with a view to minimizing their vulnerability, pursue a low carbon growth path dictated by principles of the Green Economy, sustainable development, and poverty reduction; and orient governance, knowledge systems, planning, and national regional/international structures to treat climate change as a development imperative[13]. The AU-STRC commissioned a study on the impact of climate change and the STI intervention where most of the challenges confronting Africa in relation to climate change impacts are further portrayed per sector with recommendations on how to curtail them[14]. It also stressed the need for development of green innovation policies and to advocate for carbon friendly technologies and practices. In furtherance, the study requested the African Scientific Committee to focus on building the required capacity to confront a myriad of challenges of the impacts of climate change that will encompass development of research plan and proposals that targeted the challenges of mitigation and adaptation to climate change in different sectors of research and development.

Embracing Science, Technology and Innovation, potentially enables effective responses that permits the exploitation of beneficial opportunities such as green financing and technology transfer. [15] The report on sustainable development in Africa and the outcomes of the Africa Regional Consultative Meeting on the Sustainable Development Goals reiterates the importance of innovation in dealing with the continent's social and environmental challenges including climate change.[16]

At the national level, while most AU Member States have developed strategies and policies to promote green growth, very few have made important strides in advancing green innovation to help catalyse the achievement of the strategies. In this group, there is Rwanda's Green Growth and Climate Resilience Strategy 2011–2050 [17]and Kenya's Green Economy Strategy and Implementation Plan (GESIP).[18] These policies and programmes overtly or implicitly advance the transition towards green economy and green growth. For many other countries, individually and collectively, there are real opportunities for AU Member States to catalyse their transition to green growth through innovative technological and institutional solutions. [19] Relevantly, most countries have now developed national innovation roadmaps designed to catalyse innovation in general, this provides an opportunity to anchor green innovation.

The AU-GIF is designed to guide AU member states towards developing an elaborate green innovation strategy capable of engendering a sustained and successful transition to the green economy and growth. The framework specifically aims to facilitate and guide the AU Member States towards the path of transition to the green economy

[12] The African Development Bank (2015)
[13] AU Strategy on Climate Change Strategy AMCEN-15-REF-11
[14] AU-STRC (2017)
[15] AU, (2015)
[16] UNECA (2013)
[17] Republic of Rwanda (2011)
[18] Republic of Kenya (2016).
[19] AUC, (2015)

through technological, industrial, social and systemic innovation anchored on the national innovation systems. The implementation of the AU-GIF is aligned to the Agenda 2063, NDCs and SDGs i.e. (AU-GIF) so as to enable the leveraging of resources i.e. financial and technical skills to achieve both medium- and long-term development objectives. The alignment allows Member States to establish innovative financial, technological and institutional mechanisms that carry both context specific green actions and exploit global opportunities.

There are many AU Member States that view green innovation as a development pathway that will help them create green jobs in sectors that include tourism, mining, manufacturing as related and unrelated services all contributing to accelerated poverty reduction, sustainable growth and development, the restoration of environmental health, and promoting climate and environmental justice.

The green innovation focus will present an enormous opportunity for capacity building, attracting external funds, market opportunities for products and services both within and outside the continent.

1.3. Green Innovation in the context of Africa

The environmental friendly practices and its interwoven green innovation are virtually a new concept in the development phase of the African continent. As there is not much in terms of brown industries, and other anthropogenic sources of emission, Africa's carbon footprint is less than 4 per cent of the global emission[20]. Since Africa was left out of the first and second industrial revolution, the new shift is an unprecedented opportunity for Africa to participate actively in the green era of development.

For Africa to position itself appropriately in the green era of development, a comprehensive system for green innovation needs to be in place to leapfrog all other development phases experienced elsewhere to cater for the continent's needs (products and services) under the new imperatives of development. The system should help achieve green growth while meeting people's needs by supporting social justice and equity, empowering the poor through spurring inclusive innovation, that is not simply sharing the benefits of innovation more widely but empowering the poor to participate and be supported in formal and informal processes of green innovation and also to gain more power to influence the direction of innovation and making the system more sustainable and resilient to political and non-political shocks.

1.3.1. Defining Green Innovation

The AU-GIF defines green innovation based on the broader remit of innovation. Innovation is widely viewed as a way of enhancing competitiveness in technology, markets and organisation (including institutions and policies). Innovation entails doing things differently including creation of new markets or products and services, and value networks that add value to or replaces the established ones. An example is the movement from fixed telephone networks to mobile phones. In this realm, innovations can either be incremental and-or radical[21]. The former innovation builds on, refines and extends existing component knowledge without altering core design concepts and links

[20] World Bank (2008)
[21] Henderson and Clark (1990)

between them. In contrast, radical innovation relies on new technical knowledge and/or resource to create new products and processes that totally replace old knowledge and resources.[22]

Green Innovation is broadly defined as actions that promote the creation of key products, services or processes that reduces harm, diverse impacts and deterioration of the environment while optimizing on the available resources[23]. Green innovation is therefore viewed as a critical enabler in achieving sustainable development and for Africa; GI is expected to accelerate the achievement of the continent's developmental needs and aspirations. In this regard, the AU-GIF defines Green innovation (GI) as the creation and implementation of new or significantly improved technologies, markets and institutional arrangements, which lead to environmental improvement, social wellbeing and economic prosperity.

1.3.2. Linking Green Innovation to other relevant concepts/ideas

GI as an idea does not exist in isolation. Instead, it is part of several varied efforts (e.g. Green economy and growth; climate change and environmental sustainability, blue economy, among others) (see Figure 3). In other words, these terms relate to GI and are directly related to sustainable development, which emanated from a need to achieve balance between three often conflicting goals; economic growth, social justice, and environmental management. The pursuit for green growth emerged from two issues within the sustainable development agenda. The first is the wide acceptance that human economic activities are causing detrimental environmental conditions, most notable climate change which is undermining the basis of development. Second was the need to spur economic growth and development that was suppressed by 2008 financial crisis. GI is therefore seen as a solution to catalyse the transition away from traditional exploitative model of development towards low carbon, climate resilient development pathways. In other words, the green innovation is simply a conduit for delivering some of the sustainable development objectives while attending to the global intractable challenge of economic recession, poverty and climate change.

Closely related to the green economy agenda is the blue economy pursuit. The blue economy refers to the opportunities in harnessing the potential of water bodies i.e., oceans, seas, lakes and rivers to improve livelihoods, enhance resilience and achieve sustainable development. Within the pursuit of green economy, several facets of green innovations are in-built. The first global Conference on Sustainable Blue Economy was held in Africa – Nairobi, Kenya in November 2018[24]. Participating Member States agreed to pursue blue economy building on latest innovations, scientific advances and best practices while conserving the earth's waters for future generations. Key practices targeted for blue economy could facilitate green innovations due to their focus on conserving natural resource base (water bodies) while drawing sustainable development outcomes.

[22] Christensen, C. (1997)
[23] Chen et al. (2006)

[24] Sustainable Blue Economy Conference (2018)

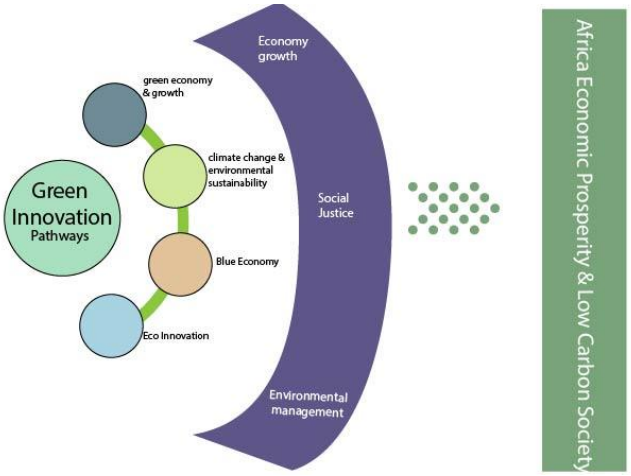

Figure 3: Pathways to green innovations.

Climate change is said to have occurred when the earth's climate system results in a new weather pattern that remains for an extended period of time while sustainability means meeting Africa's needs without compromising the ability of future generations of Africans to meet their own needs. It is a well-known fact that climate change is an impediment to economic development of Africa and is a major stressor that challenged the continent's ability to achieve ecological, economic and social objectives that define sustainability. It is also noted that potential for climate change to affect development paths themselves must be addressed via the green innovation trajectory.

In other parts of the world such as Europe, green innovations are linked to Eco-Innovation (EI).[25] Here "Eco-innovation" refers to all forms of innovation - technological and non-technological - that create business opportunities and benefit the environment by preventing or reducing their impact, or by optimising the use of resources. Eco-innovation closely relates to the use of natural resources, production and consumption practices, and to the concepts of eco-efficiency and eco-industries. It encourages a shift among manufacturing firms from "end-of-pipe" solutions to "closed-loop" approaches that minimise material and energy flows by changing products and production methods - bringing a competitive advantage across many businesses and sectors.[26] EI is associated with the ability to attract green rents on the market. EI financing has become a significant part of the European Commission Competitiveness and Innovation Framework Programme of 2007. Africa seeks similar - if not better - approaches to advance its economic growth and development that delivers green economies. The GIF is important in that regard.

1.4. Rationale for the AU-GIF

Three major rationales anchor the pursuit for an AU-GIF: (i) a need to innovate for the realisation of the broad sustainable development in Africa - the green economy is an integral part of "green growth" innovation objectives, (ii) a need to tap into associated opportunities, and (iii) a need for platform for green coordination and lesson sharing.

[25] Murzin D and Szija C. (2017)
[26] Mario, P (2011)

1.4.1 Innovating for sustainable development in Africa

GI provides robust and efficient ways of achieving the sustainable development objectives outlined by AU Member States. Green growth aims to enable countries achieve economic development, simultaneously with managing the natural capital base while remaining resilient to environmental and socio-economic shocks. Many AU Member States remain committed to the green growth as a means to promoting contemporary national development agendas. Green growth therefore provides countries with an economic model that identifies and pursues sustainable development pathways and strengthens synergies between economic, social and environmental objectives. The AU-GIF provides financial, technical and institutional connections that produce new and-or significantly improved products, processes markets and outcomes leading to achievement of green growth and broader sustainable development. Experience from most of the OECD countries indicates that green innovations improve the competency, inclusivity and sustainability of economic growth actions and plans. In Africa, there is space for green innovation to catalyse green growth in agriculture (smart agriculture), energy, transportation, and manufacturing and the natural resources sectors, among others.

1.4.2. Tapping into the Green Innovation opportunities

Innovation (scope, depth and pace) cut across all field of lives and helps to leverage critical human capital bound, hard and soft infrastructure technological readiness and technical capabilities without which specific policy strategies will not be successful. While Africa has historically been marked as the poorest continent characterised by economic inequalities, environmental degradation and rapid demographic booms, lately the continent is rapidly emerging as a driver of the global economy due to its inherent natural resource base such as oil, minerals, wildlife, land and of course its people. The development of green, inter-connected and knowledge-based economies in Africa presents development opportunities for the continent. There are prospects for new industries, d, enhanced production and consumption to propel the continent to a higher prosperity. Competent processes, industries and products could open up new intra-Africa and international trade opportunities for the continent through value addition as well as enhanced quality and quantity of agricultural and mineral products from the continent. This will further enable to the continent to venture into new export markets and products/services such as renewable energy, and other green products

Based on current trends, Africa's population is projected to double in size by 2050 presenting the biggest demographic boom in the globe. This population does not only present a substantial work force and capability but also provides a big market for new products generated through green innovation. The African Continental Free Trade Agreement (AfCFTA) is posited as a means of developing important manufacturing and trade links that will create jobs and develop the much needed economic and social infrastructure. The AU-GIF can serve as a compass that ensures that developments under the AfCFTA thrust do not stray off the sustainable development trajectory.

In addition, the AU-GIF will allow Africa to tap into emerging green financing opportunities including green bonds, Green Climate Fund (GCF), green technology transfer among others. For instance, the GCF aims to finance green innovations in developing countries as a means of mitigating and adapting to climate under the Paris Agreement. The establishment of the GCF to support green innovations for climate

change mitigation and adaptation reveals the strong connection between green growth and global climate goals. Already, industrialised countries committed to mobilise US$ 100 billion to support both mitigation and adaptation through the GCF under the Paris Agreement (Figure 4).

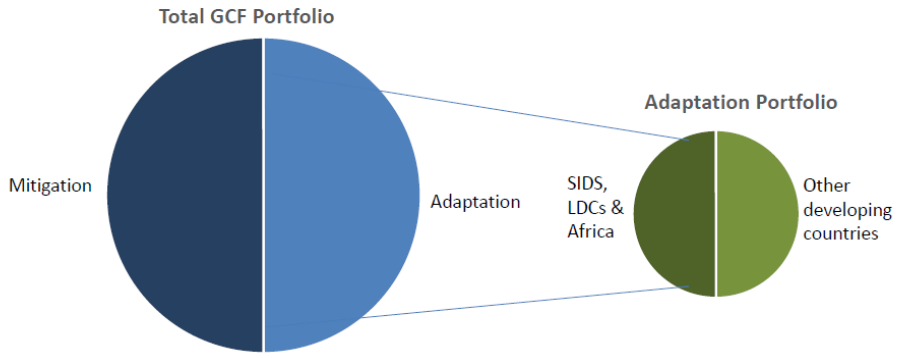

Figure 4: GCF Allocation per sector and per region: Equal allocation of the Fund to both Mitigation Adaptation. Out of the Adaption allocations 50% will be channelled to LDCs, SIDS and Africa

Evidence shows that a practical GIF depends a lot on technological readiness and innovation capabilities without which specific policy strategies will not be successful. This implies that policies that are critical for the operationalization of green growth/economy policies put in place by various African countries will in turn depend on particular innovations that can help translate these policies into action. In essence, this is a call for a system in which innovations - as tangibles and intangible - interact, reinforce and ratchet each other continually. There are also opportunities for Africa to gain from global green innovation pursuit, global technology exchanges and skill development agenda of the new climate change policy and other global environmental agreements. For instance, under- the Paris Agreement, the Technology Executive Committee (TEC) of the UNFCCC has established a work stream on "strengthening innovation systems (IS) for climate technology transfer (TT) and development." These and other complimentary initiatives represent a significant opportunity for African countries to leverage support via the UNFCCC and other development agencies to strengthen their capabilities around climate technologies in ways that will underpin effective design, lobby for and implementation of technological decisions that resonate with Africa's circumstances, long-term economic growth and overall resilience of the African people.

It is also widely acknowledged that while the green economy agenda emerged from a need to find lasting solutions to multiple global crises - notably global warming, climate change and degradation of ecosystems - it has the potential to help countries address many other pressing problems such as unemployment, income inequality, food security, energy insecurity and environmental degradation. An influential study by UNEP/ILO in 2008 suggested that the number of green jobs in the world might increase from 2.3 million to 20 million from 2006 to 2030. The AU-GIF provides a pathway for the African states to tap into these green jobs and create employment for its rising population especially its youth.

1.4.3 A platform for green growth coordination and lesson sharing

African economies are characterised by a deficit of technical capacity and capabilities. It is against this backdrop that an AU-GIF provides an opportunity for AU Member States to engage closely and share lessons in their pursuit of green growth through sharing experiences and the utilisation of pooled resources that address individual and collective deficits. This is critical because different countries are at different stages of implementing their green growth agendas. Some countries are more advanced than others are, and have put in place more advanced institutional arrangements to tap into associated green growth technologies, innovations and finances. Other countries are still struggling. As such, an AU-GIF has the potential to create a co-ordinated platform through which countries learn from each other, share progress, best practices on green technological advancements and institutional arrangements, and come together to lobby for massive resources and relevant innovations towards their green growth plans and strategies and commitments to the Paris Agreement through the Nationally Determined Contributions (NDCs).

Chapter 2: Situational analysis

This section provides a short review of the policy context relevant in developing the AU-GIF. It is undertaken in recognition of the fact that these initiatives provide both the impetus and vital tools and opportunities of innovation strategies and efforts at both the national, regional and continental level. It is often the case that the international and continental agenda largely frame the policy thrust of AU Member States in the broader development policy spaces as such the case in green economy. The section also reviews key global financial, technological and market trends relevant for framing green innovation at the AU and its member state level.

Three elements are core to Green Innovation: (i) Policy and institution architecture and form; (ii) Finance as an enabler and lubricant of initiating, advancing, and maintaining the innovation cycle, and (iii) Stakeholders that determine and act within this policy and institutional architecture.

2.1. Policy Landscape

The policy landscape for green economy in Africa is evolving quickly. The policy setting for AU-GIF is bound by the 2030 SDGs and the Paris Agreement (NDC implementation framework) at the global scale; the AU agenda 2063, AU Climate Change Strategy, Africa Industrialization Development Strategy, STISA-2024 and other development policies and strategies at the continental level; while on the RECs levels regional policies in all the development sector along with their regional STI policies and strategies; and at the National level, the GIF is bounded by green growth policies, climate change policies and the national STI policies (Figure 5). These policy domains further strengthen the linkages between green innovation and pathways such as sustainable development, climate change and eco-innovation.

2.1.1. Green Innovations and the SDGs

Africa's Agenda 2063 works in tandem with and compliments the global drive - the 2030 Agenda for Sustainable Development and its associated 17 SDGs. The goals provide a global framework for achieving sustainable development in its three dimensions of balanced and inclusive economic, social and environmental development emphasising the need to leave no one behind in the process of development. The SDGs build on a green innovation premise laid down during the Rio+20 Summit in Brazil (June 2012) that positioned the ground-breaking guidelines on applying green economy policies as useful tools in advancing sustainable development and ending poverty.

Although 2030 Agenda and Agenda 2063 are not identical, the two show considerable overlaps at the level of goals, targets and indicators. The AU and the United Nations (UN) realise this, and have developed and agreed on the AU-UN Framework on Implementation of Agenda 2063 and Agenda 2030. The implementation of the GIF is aligned to the timeframe of the SDGs i.e. 2030 to effectively and efficiently exploit scarce resources and leverage of inherent synergies between various concurrent agendas. The framework seeks to exploit synergies between the two agendas in a quest to avoid a waste of resources from possible policy incoherencies arising from a simultaneous but un-coordinated implementation of the two agendas

Figure 5: Policy setting for green innovations in Africa

2.1.2 Green Innovation and the Paris Agreement

The Paris Agreement (PA) reached at the 21st Conference of Parties (COP 21) of the United Nations Framework Convention on Climate Change (UNFCCC) anchors its vision on green growth as a means to achieving the global climate goals through mitigation and adaptation actions. The Agreement has given explicit attention to the role of innovation as a means to supporting green technology transfer and implementation especially in developing countries.

Important aspects of innovations have been lodged in the Agreement, especially for developing countries. First and notable is the 'new' flexibility around accessing the Green Climate Fund (GCF). The flexibility allows developing countries to access this fund to finance green innovations under the guise of climate change adaptation and mitigation.[27] This addresses the shortcomings of the Kyoto Protocol where African countries attracted relatively fewer green investments compared to China under the

[27] Ockwell D. and Byrne R. (2015)

Clean Development Mechanism (CDM), a mechanism that is designed to support investments in green projects for mitigation and resilience building. This outcome is attributable to a lack of technical and institutional innovation systems in Africa that could enable the development and, implementation of competitive CDM projects.

Second and more important is that the Agreement also directly supports innovation. For instance, the Technology Executive Committee (TEC) to the UNFCCC launched a work stream on "strengthening innovation systems (IS) for climate technology transfer (TT) and development." The Paris Agreement marks for the first time a Convention that has considered the building of green innovation systems. This move represents a significant opportunity for African countries to leverage support via the UNFCCC and other development agencies to strengthen their capacity and capabilities around green economy transitions and climate technologies in ways that will underpin effective design, lobbying and implementation of technological decisions that resonate with Africa's circumstances[28]. This is good for the continent's long-term economic growth objective of improving the overall resilience of African people.

2.1.3. Green innovation and the Agenda 2063

The objective of Agenda 2063 is to alter, within a 50-year period, the image and development trend of Africa as a continent that is characterised by poverty, disease and other related adverse afflictions. Through this Agenda, the AU envisages building a continent with reduced levels of poverty through creating and maintaining sustainable economies, which deliver jobs for its youthful population, ensures good health, peace and tranquillity for all.[29] This transformation seeks to realise minimal or preferable no irreversible damage to the environment. This is cognisant of the fact that the current developed economies did not face similar demands. Nevertheless, and despite this, the first of the seven aspirations of Agenda 2063 explicitly refers to avoiding a similar growth and development trajectory by articulating a vision of a *'…prosperous Africa based on inclusive growth and sustainable development*'[30]

Innovation is core in this endeavour. To deliver this, Agenda 2063 explicitly refers to a vision of a continent that is a '*knowledge society through transformation and investments in universities, science, technology, research and innovation, and through the harmonization of education standards and mutual recognition of academic and professional qualifications*," (The African Union Commission, 2015:15). Hence, the GI presents a breath of opportunities in actualizing the aspirations. The vision is a tacit reference to an economically developed and developing Africa producing, consuming and exporting green goods and services for both economic and other social uses in all aspects of human activities.

2.1.4. Green Innovations and the STISA 2024

The AU is cognisant of the critical role of Science, Technology and Innovation (STI) in delivering a sustainably growing and globally competitive Africa. STI is set to drive sustainable economic transformation through sustained investments, competitive and

[28] UNFCCC (2015)
[29] African Union Commission- AU Agenda 2063 (2015)
[30] AUC, (2015: 2)

continuous innovation in areas that include the exploitation and use of natural resources, the provision of energy, health and education.

The roots of the Union's appreciation of the role of STI in delivering (sustainable) development in Africa date back to the Monrovia Strategy in July 1979, and the Lagos Plan of Action (LPA) for the Economic Development of Africa [1980–2000], Final Act of Lagos in April 1980, and the Consolidated Plan of Action (CPA). Since the end of the CPA in 2012 there have been numerous discussions centred on the need to have a continental strategy in light of the dynamic development and transformation on a technological front to address the emerging technological and development challenges driven by innovation. There were agreements on the issue that led to the birth of the Science, Technology and Innovation Strategy for Africa (STISA-2024). This strategy is part of a set of five 10-year strategies that seek to elevate STI to the commanding heights of Africa's social and economic development within the context of the AU's Agenda 2063.

The prime objective of all these continental strategies is to secure an economically stable and successful continent through timely and appropriate transformations sustained by investments in new technologies and continuous innovation in areas where Africa has comparative advantages i.e. agriculture, clean energy as well as where it lags behind other regions such as education, health and bio-sciences. This demands for innovative strategies for the Agenda which also highlights the importance of curbing the loss of skilled and experienced human capital in science, research and technology.

The *STISA-2024* is anchored on the priority areas critical to the achievement of the AU vision of "An integrated, prosperous and peaceful Africa driven and managed by its own citizens and representing a dynamic force in the international arena". The strategy further defines the reinforcing pillars central to the achievement of the desired sustainable growth of the continent. The critical pillars to the use of STI in accelerating sustainable development in Africa include building and/or upgrading research infrastructures; enhancing professional and technical competencies; promoting entrepreneurship and innovation; and providing an enabling environment for STI development in the African continent as shown in figure 6.

2.1.5. Green innovations and other Africa's developmental frameworks

Africa currently has a range of continental policy frameworks targeted at spurring development of key sectors such as agriculture, trade, transport, energy and mining. These include the Comprehensive African Agricultural Development Programme (CAADP), The Programme for Infrastructural Development in Africa (PIDA), The African Mining Vision (AMV), Boosting Intra African Trade (BIAT), Accelerated Industrial Development for Africa (AIDA) and the Continental Education Strategy for Africa 2016-2025 (CESA 16-25) among others.[31] These frameworks provide anchorage for green innovation technology prioritisation and envisaged skill developments. These sectors have been identified as critical in enabling Member States of the Union to achieve their development goals with underlying innovation. For instance, the Malabo

[31] AU (2019) - Continental Frameworks

declaration of 2014 updated the CAADP framework to include agricultural innovations that will spur climate resilience for 25million smallholder farmers by 2025.[32]

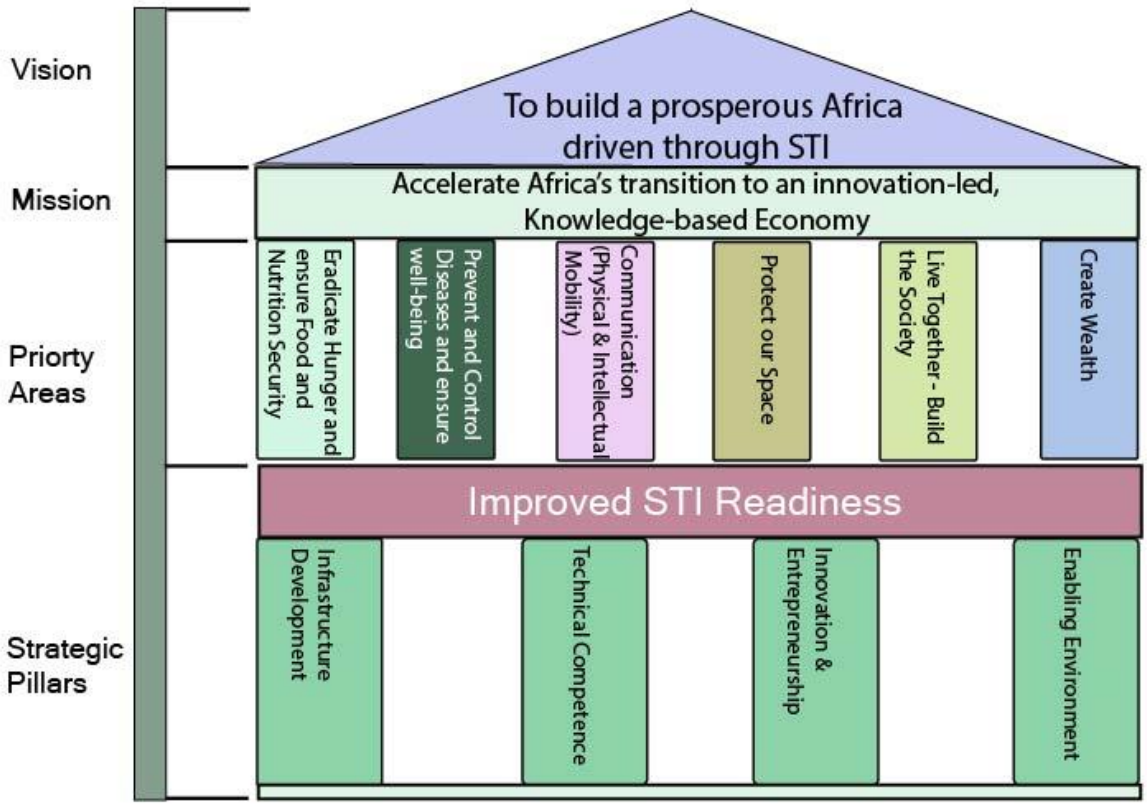

Figure 6. The building structure of STISA 2024

2.1.6. Green Innovation and RECs

Innovation is recognized as a key ingredient in RECs' development agenda and policies. Regional treaties have long recognized STI and its impact on the regional development and growth: Article 3 of the COMESA Treaty[33] commits Member States "to co-operate in the creation of an enabling environment for foreign, cross border and domestic investment including the joint promotion of research and adaptation of STI for development." Article 27 of the ECOWAS Treaty[34] lists the commitments of member states on STI as a means to generating Africa's own capabilities and products for socio-economic transformation[35]. Similarly, Article 21 of the SADC Treaty identifies STI as an area of cooperation among the Member States. The SADC States adopted the declarations on STI in 2006 and ratified the SADC Protocol on Science, Technology and Innovation in 2008[36]. These and other cases demonstrate increasing recognition of innovation in accelerating growth in general and green growth in particular.

[32] AU (2014)
[33] Revised COMESA Treaty (2012)
[34] Revised ECOWAS Treaty (2010)
[35] https://www.uneca.org/sites/default/files/PublicationFiles/aria7_eng_chap5.pdf
[36] SADC (2008)

While there is no single regional green economy strategy for the AU Member States, various regional economic, political and financial bodies have embodied green innovations in their climate change and green economy plans.

The focus has shifted towards delivering green growth through activities in Regional Economic Communities (RECs); such as COMESA, SADC, IGAD, EAC, where innovative ways of utilising infrastructure development to support green economy are considered. These bodies recognise STI as a catalyst to the green growth in Africa's priority sectors such as agriculture, energy and transport, that is clearly articulated in their sectorial policies such as the SADC Regional Infrastructure Development Master Plan for the ICT, water, transport, tourism and meteorology sectors (2012), Regional Indicative Strategic Development Plan which identifies priority development areas and action plans.[37] The COMESA Regional CAADP Compact[38] and the ECOWAP (Regional Agricultural Policy for West Africa)[39] are also a sectorial policy and strategy for the regional agricultural sector. This commitment was reflected at the output of the Africa High Level Ministerial Conference of Green Economy in Algeria in 2014[5] where they adopted a joint commitment towards environmental protection and the development of a green economy in Africa.

2.1.7 Green Innovation and national green growth strategies

Building on the robust global and regional policy environment, various AU Member States now view the green economy and its related innovations as a development pathway that may help create (green) jobs, accelerate poverty reduction, support sustainable growth, restore environmental health, and promote climate and environmental justice. The national processes provide context for action and operationalization of this innovative framework. To this end, a number of African countries have developed national green growth strategies with focus on country contexts. For instance, Kenya's Green Economy Strategy and Implementation Plan (GESIP)[40] and Uganda's Green Growth Development Strategy (GGDS): have proposed sector based green actions[41] sector based actions whereas the Rwanda's Green Growth and Climate Resilience Strategy 2011–2050 [42]and those from Ethiopia, and Tanzania emphasise national integrated actions embedded across development plans (Also see annex 1for detailed outline of various green growth related policies among the EAC countries).

A survey conducted by the AU-STRC found that not all AU Member State have green growth/economy policies. Only a few have explicit policies in this regard. The existing policies have usefully identified areas of investments that could spur green growth including investments in renewable energy, forestry and agroforestry, promotion of resource-efficient and cleaner production, enhanced resilience to economic and climatic shocks, pollution control and waste management, environmental planning and governance and restoration of forest ecosystems. However, most of these policies lack clear plans on how to catalyse these investments through innovation. Instead, green

[37] SADC Regional Indicative Strategic Development Plan (2001)
[38] COMESA Regional CAADP Compact (2010)
[39] ECOWAP (2005)
[40] Republic of Kenya (2016).
[41] Africa Sustainability Hub (2016)/; http://www.acts-net.org/images/CRE/CRIBS/CRE-CRIBS-01.pdf
[42] Republic of Rwanda (2011)

innovation is only mentioned in these few samples and with some referring to the National STI policy as possible facilitator of green actions. To this extent, some Member States have green innovation embedded in their Science and Technology and/or Energy policies but greater majority do not have stand-alone policies on green innovation or green innovation mainstreamed in existing green growth/economy policies.

2.1.8. Green innovation options

In line with various policies, the implementation of green innovation draws on a number of options and associated outcomes. These options are discussed in section 1.3.2. 'linking green innovation to other relevant concepts/ideas. These options including eco-innovation ideas are drawn from other contexts such as the blue economy thrust among others which provide pathways towards achieving green innovation in practice while leveraging on the opportunities provided by the national, regional and global policies.

2.2. Financial and technical landscape

Financing green growth is critical to the full realization of SDGs envisioned in the AU agenda 2063. Regional financing institutions such as the African Development Bank can play a critical role in fostering green growth by prioritizing focal areas of sustainable management of natural assets, financing sustainable infrastructures and building resilient livelihoods. Every development and growth pathway have cost implications and green growth for Africa is not an exception. In this regard, the African Development Bank (AfDB) plays a central role as a continental financial body. The AfDB has developed a framework to promote the bank's engagement in fostering the transition to green growth in Africa[43]. The transition to green growth is anchored on maximizing natural resource use efficiency, minimizing waste and pollution; and building resilience of livelihoods and economic sectors. The bank has specific focal areas of focus for Green Growth in Africa and promotes mainstreaming of green growth into national development planning processes in Africa. The bank therefore plays a major role to promote green innovation and growth through financing growth in the identified focal areas in the continent.

There are a number of international green financing mechanisms including the GCF, CDM, GEF accessible to African countries but many African States are yet to fully explore the instruments and align their competence and development efforts towards green growth. The *CDM* allows emission-reduction projects in developing countries to earn certified emission reduction (CER) credits, each equivalent to one tonne of CO_2, which can be traded and used by industrialized countries to meet a part of their emission reduction targets under the Kyoto Protocol.[44] The continent has not been able to equitably compete for these funds due to a number of reasons most prominently a weak and limited ability to innovatively identify, develop and implement relevant projects. The need to enhance such capability is critical for Africa even as the continent hopes to do better under the Paris Agreement.

[43] AfDB (2014)
[44] UNFCC Clean Development mechanism (2013)

To improve the financial flow for the continental green growth programs, the private sector involvement is central. The continent strives to promote programmes that unleash private sector finance. To this end, Foreign Direct Investment in Africa has significantly increased by 11% in 2018 according to the United Nations Conference on Trade and Development (UNCTAD).[45] Promoting green FDI to focal green growth programs and development areas is paramount for green growth in Africa.

There are opportunities for private sector financing of green growth in Africa. However, the sector is yet to be well organised and linked to green growth. Again, this is a consequence of lack of appropriate green innovation frameworks that could spur business opportunities to incentivise private sector involvement.

Public financing through budgetary allocation remains minimal because most countries have very minimal or no budgetary allocation to support green growth despite enacted and defined policies, legislation, programmes and projects in this space. All this undermines the growth of green technologies and retards the development and uptake of green technologies in Africa.

The paucity of financial ecosystem for green growth in the continent is both a driver and outcome of skills and technical capacity deficit in the green economy space. Its impact manifests as a lack of adequate investment in Research & Development (R&D), product development and all other aspects of innovation critical for propelling the green growth agenda. However, there are emerging centres of excellence and institutions for capacity building such as Universities but these will need to be tailored for specific competencies. Indeed, some African countries such as Kenya, South Africa are now embracing competency-based education systems as a means of generating critical mass of capabilities to confront the intractable challenges the continent faces.

Overall, Africa still grapples with financial and technical landscape challenges. The continent lacks a fully developed green finance ecosystem with its associated green finance instruments. Addressing this requires the joint focused contributions of the respective governments, international development agencies, non-governmental organisations and the private sector acting in unison to trigger business models for scaling up green technology start-ups, incubators, green technology hubs, incubation and learning centres. African governments need to enact deliberate policy incentives to this end, targeting specific sectors and more important, ensuring systemic irreversible but sustainable changes.

2.3. Market landscape

Africa is one of the fastest growing consumer markets in the world attributable to population increase and new investment opportunities. The average household consumption has been on the rise since 2010. The global market for green technologies is however, wide but relatively underdeveloped in Africa compared to other regions. This emanates from trade barriers that discourage local (African) production. Tariff and non-tariff barriers that inter-alia include high import duties, the non-adoption, non-ratification or limited or no implementation of some provisions supportive to green

[45] UNCTAD World Investment Report (2019)

technologies and generally low compliance with regional policies aimed at the removal of trade barriers.

It is widely recognized that there is a weak commitment on the implementation of protocols and intra trade and market agreements, for instance, the Protocol on Environment and Natural Resource Management (NRM), which promotes the development and efficient use of renewable energy sources such as solar, wind and geothermal, has not been fully adopted and ratified by all EAC partner states. Another example is the processing of a single customs territory document that in Tanzania takes up to 10 days instead of the stated three days, thus slowing down cross-border trade.

The recent Africa Continental Free Trade Agreement (AfCFTA) avails a means of overcoming the traditional barriers to Africa-based production of goods and services as well intra-Africa trade in such. The AfCFTA drive has the potential to create a critical mass of demand for green goods and services which in turn will demand green production processes supported by equally green hard and soft infrastructure. The AfCFTA avails viable (potential) economies of scale of intra-Africa production and consumption of green goods and services that create space for innovative green financing instruments.

As the continent develops its market it is worthy to note that the adoption and sustainability of foreign technologies has remained weak largely due to lack of established innovation systems that could promote technology incubation and support particularly at state level. The various countries operate individually and miss opportunities that cross-border co-operation could avail. Against this background there is therefore a need to develop and enhance intra-Africa technical cooperation to grow skills and develop linkages for effective technology transfer. This has the potential to limit the magnitude and depth of green technologies, imports from India or China that currently dominate the green economy hardware in many AU Member States resulting in a weak growth of the much-needed manufacturing jobs.

2.4 Stakeholder landscape

The successful implementation of any policy initiative and its related programmes is dependent on balancing the views and opinions of individuals, groups and organisations with interest in such initiatives.[46] In most cases, Africa's research is driven by external partners and responds more to funders' directions, guidance and priorities. The varied views between and within stakeholders 'individuals, groups and organisations', are important hence, policymakers, governments and firms need an analytical and systematic process for stakeholder analysis to provide the basis for stakeholder management strategies to minimise risks and enhance potential benefits, recalling that stakeholders - carries both the risks and potential benefits.

Africa is characterized by countries with different political arrangements. This presents different plausible approaches to stakeholder analysis. What is important is that outside

[46] Jordan (1999)

an absolute dictatorship that can forcefully impose innovations, culture is a critical component of the pace and extent of acceptance of new ideas and technologies.

Details of stakeholders that are both directly and indirectly active in the innovation space in Africa and elsewhere are given in (Annex 1). Stakeholder analysis was undertaken through document review of policies and agencies and involved in green growth from international, regional to national levels. This makes stakeholder analysis imperative to the AU-GIF.

Chapter 3: Core Principles of the African Union Green Innovation Framework (AU-GIF)

The AU-GIF has four core principles as shown in figure 7: i) linking Africa's Green Innovation systems with the Science, Technology and Innovation Strategy for Africa, *STISA-2024*; ii) AU-GIF2030 is anchored on the National Innovation Systems (NIS) of AU Member States, many of which have already invested to various degrees in developing national science, technology and innovation roadmaps; iii) meeting Africa's development challenges; iv) transition from emergency/crisis response to towards long-term visioning.

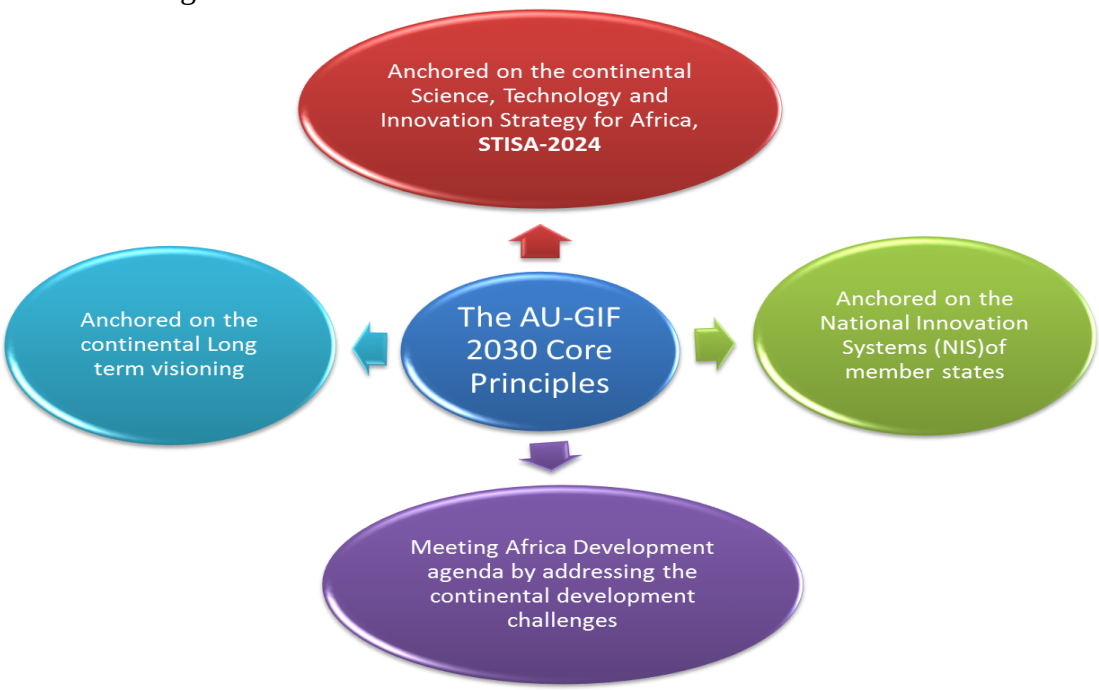

Figure 7: The AU-GIF Core Principles

3.1. Anchoring AU-GIF with STISA- 2024

Launched in 2014, the STISA-2024 is now in its fifth year of existence. As the first of a set of 10-year incremental phasing strategies, *STISA 2024* has another five years to run after which it will be replaced by a second 10-year plan. The *STISA* document correctly identifies science, technology and innovation as the desired engine for driving African's economic growth in the context of Agenda 2063. *STISA* recognises that African economic development needs to be pursued within safe environmental limits. Accordingly, value addition, conservation and sustainable use of resources are all identified as important aspects to which science and innovation should be applied.

Massive investment in infrastructure, tertiary education, research and development, and the building and promotion of technical competences and the culture of entrepreneurship across sectors are all seen as pillars of a credible STI in Africa. Linking the AU-GIF 2030 with the existing STISA 2024 and indeed future STISA Strategieshelps to build as much as possible on the existing systems already put in place by the Member States. This will be achieved by considering the STISA priority areas under this framework. Such a linkage will ensure synergy while avoiding

redundant and wasteful overlaps. For instance, climate change is understood as a crucial source of multiple stressors that exacerbate hunger, poverty and human vulnerability in Africa. Accordingly, the AU-GIF should be seen as a tool for achieving the broader objective of economic prosperity for Africa through building resilience to climate change and accelerating the continent's transition to a sustainable, green, and knowledge-based economy.

3.2 Anchoring AU-GIF on the National Innovation Systems

The National Innovation System (NIS) of AU Member States provides a systemic context and bedrock from which the continents transition to an innovation led and knowledge-based economy will occur. NIS refers to a set of actors, institutions and skills that function and interact to create learning conditions for innovative social, environmental or economic solutions (technologies, ideas etc.) to emerge and successfully thrive in a particular context[47]. NIS has long been identified as a key driver of successful innovation the world over.[48]NIS provides a safe and controlled space for investments, policy experiments, technology incubation, technology development and other vital elements needed to nurture innovation. Emphasis on NIS is also vital for allowing each country the flexibility to determine its own priority sectors, approaches, technologies and pathways to green transition.

In many AU Member States, the NIS is an integral part of the STI investments and provides a good anchorage through which the AU-GIF can be stimulated and directed. The AU-GIF will benefit immensely from the STI investments that are currently being pursued in line with the African Union's *STISA- 2024* and Agenda 2063. The investments focus on supporting innovative solutions that exploit strategic interventions and linkages between green technologies, skills, institutions and policies as catalysts to the achievement of SDGs and broader economic prosperity

For example, Tanzania's National Fund for the Advancement of Science and Technology, Science and Technology Development Fund by Arab Republic of Egypt, and Kenya's National Research Fund and National Innovation Agency all aim to leverage capability and innovation building. The National Research Foundation, the Human Sciences Research Council, the Council for Scientific and Industrial Research, Medical Research Council in South Africa are in place to support innovation. In addition, a number of non-state actors such as think tanks, private consultancy firms, and Consultative Group on International Agricultural Research (CGIAR) Centres of Excellence could also provide leverage for green innovation.

African countries also thrive in a vast array of informal innovators such as the *Juakali* sector in Kenya (contributing close to 40 per cent of the economy) that are being nurtured. Countries such as Tanzania and Rwanda are establishing innovation hubs to account and nurture such informal skills.[49] Kenya has also established the Kenya Innovation Agency (KENIA) to help manage and upscale the informal skills and innovators while Rwanda has established the Home-grown department to nurture and leverage on the informal innovations to grow its industries.

[47] ACTS, (2016)
[48] OCED, (2016)
[49] World Bank (2016)

While these platforms provide valuable opportunity to drive green innovation, most of the strategies do not yet or explicitly accord green innovation a prominent place in their plans. Going forward, it would be necessary to encourage countries that are yet to develop coherent NIS to do so urgently. Countries that already have a NIS in place should be encouraged to review their systems to ensure that they strongly incorporate green innovation.

3.3. Anchoring AU-GIF to the National Development Agendas

The framework is premised on the principle that Africa's green innovation approach must be targeted at meeting Africa's development challenges. Most STI policies align to the countries' development vision like the Ghana 40year development plan (2017-2057), Zambia Vision 2030, Uganda Vision 2040, and South Africa's National Development Plan Vision 2030. Recently, there have been efforts to align most of the policies with the SDGs[50]. This framework provides an opportunity for GI to provide linkages between NIS, National Development Plans and Visions, Africa Agenda 2063, NDCs and the SDGs.

Linking GI and national development agenda can provide opportunities for efficiently and effectively harnessing green innovation to respond to articulated national development objectives in the context of a global sustainable development agenda and ultimately to the AU Agenda 2063 aspiration. African's green innovation approach must also be agile, adaptable and far-sighted. While being responsive to current challenges and trends, there is a need for futuristic thinking and long-term approaches to prevent Africa from falling behind in a fast- moving world.

3.4. Anchoring AU-GIF on a long-term vision

The framework envisions combining immediate needs with long-term horizon thinking. Previous experiences point to the need to move away from emergency, short-term, reactive approaches towards long-term systematic approaches underpinned by a clear vision, strong processes and a commitment to continual improvement. This will include building technological and institutional capabilities that are conscious of future needs. This is achievable through establishing mechanisms that do not only respond to present and discernible opportunities but instead allowing for space for emerging known and unknown opportunities. The AU-GIF is therefore anchored on sustainable development pathways – a long term development agenda for the national, continental and global levels through the National green growth policies and strategies, the Africa development goals through the Agenda 2063 and the STISA-2024 and the global Sustainable Development Goals of 2030.

[50] https://unctad.org/meetings/en/Presentation/enc162018p14_Arimoto_en.pdf

Chapter 4: Pillars of the AU-GIF

Previous studies of innovation have shown that although innovation can often be a chaotic process, without clearly ordered and predictable pathways, it is nevertheless valuable to provide a framework through which innovation can be stimulated and directed. A framework in this context is understood as a set of interrelated components whose activities and interactions produce specific outcomes. This AU-GIF is conceptualised to provide a structure within which various stakeholders including governments, RECs, think tanks, Universities, Development Partners form and implement actions to spur, improve and direct green innovation process. It is important to emphasise that while governments and formal state institutions are key parts of a national innovation systems, the role of non-state actors such as firms, business, entrepreneurs, and the civil society is also very crucial.

Analyses of national innovation systems have traditionally tended to be technology-based often with a focus on inputs (such as R&D expenditure) and outputs (such as patents). While this approach has its value, it is now increasingly recognised as inadequate for capturing the complex social systems and their interconnections that underpin and shape innovation – especially in Africa. A socio-technical approach to green innovation recognises that any innovation is first and foremost about people "the culture they have created or adopted; their approach to life; their attitudes and social norms; who they work with; and what they consider important. In this regard, the green innovation for Africa is unique to the diverse communities and social fabrics in Africa.

Further, it has been noted that the key feature of green innovation is that it is mostly purposive. This implies that it is often intended and pursued to reflect a broad set of interests and forces. Green innovation in Africa is the mechanism to foster the overall growth of the continental (green) economy by building on the natural capital, enhancing sustainable growth and establishing resilient African communities to global, regional and local shocks of climate change, disasters and resource depletion.

Drawing on the definition of green innovation, the African Circumstances (under situational analysis) and the core principles discussed in the previous chapters, green innovation should encompass not only technological innovations but also institutional and social innovation.[51] Based on this, four pillars were proposed to constitute the AU-GIF (Figure 8): (i) Technology systems and skills, (ii) Knowledge systems (iii) People and society and (iv) Regional/national enablers (policies and strategies) this all to be accompanied with a robust financial/funding systems and mechanisms.

[51] UNCTAD (2019).

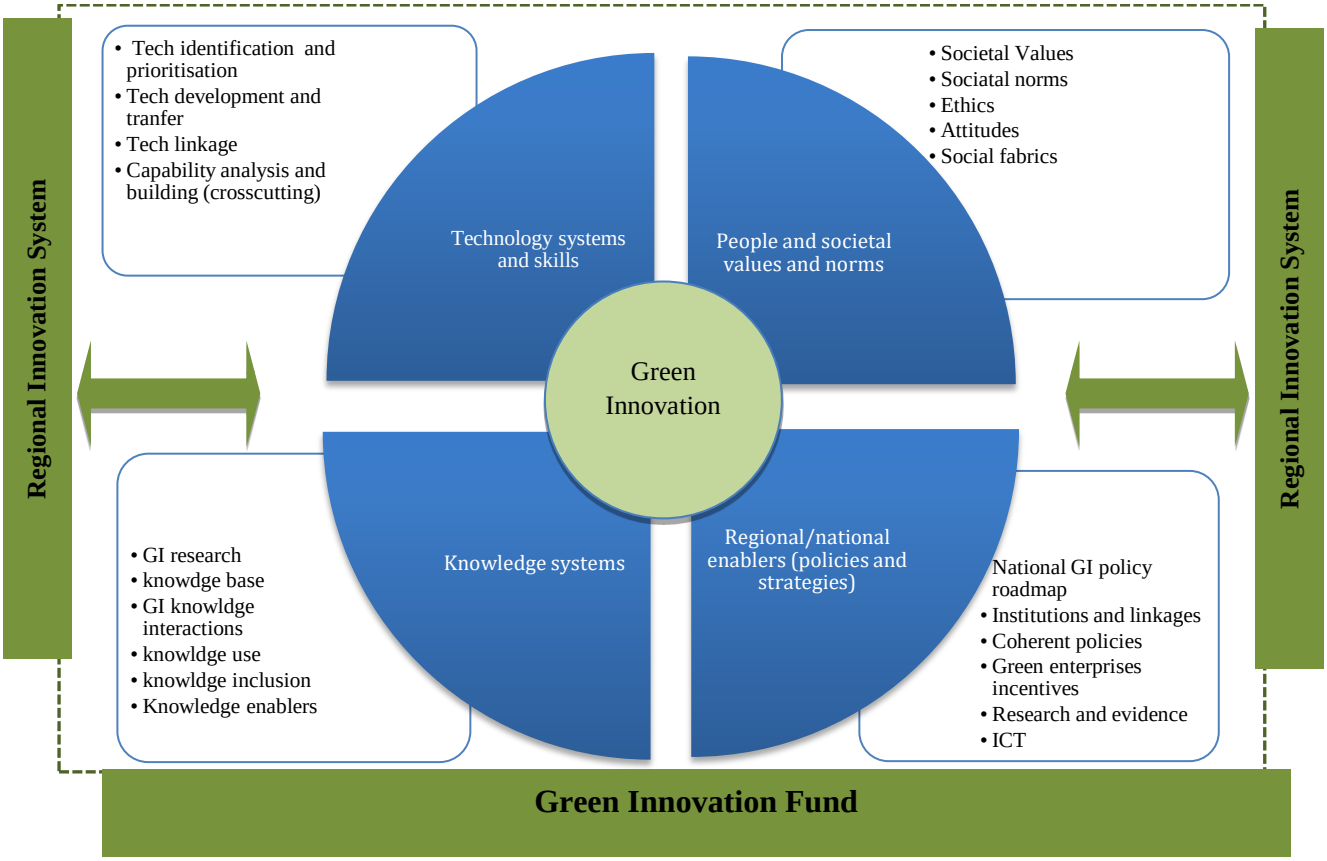

Figure 8: Pillars of the Africa Union Green Innovation Framework 2030 (AU-GIF)

4.1. Technology Systems and Skills

The extent of green innovation of any nation is underpinned by the stock of technology and skills base and system of that nation. Technological systems are sets of interconnected components that transform, store, transport, or control materials, energy, and/or information for particular purposes. In other words, a technological system is a system that takes an input, changes it according to the system's use, and then produces an outcome. Any technological system is based on the following: input, output, transformation, and control. The system may include several sub-systems that influence/support the technological system and these sub systems interact between and across many levels to produce an outcome over time[52].

Key elements of technology systems include; understanding technology needs, putting in place mechanisms for developing or harnessing new technologies, creating linkage and interactions between these technologies for optimal outcomes and developing required skills and capabilities towards developing new green technologies but also to implement existing ones.

For the purposes of green innovation, Africa's technology systems need to be strengthened targeted and be made systematic. Currently, most African member states have outlined green

[52] Yang (2019) Technology systems available: https://study.com/academy/lesson/what-is-a-technological-system.html

technological prepositions in various policy and strategy documents at continental (e.g. Africa Mining Vision, AU Climate change strategy), regional or national levels (e.g. national green growth strategies or climate change policies). The AU-GIF proposes a systematic approach that will help strengthen existing systems and help develop new ones. The action areas include: green technology identification and prioritization, green technology development and transfer, green technology interactions and capability/skills building (Figure 9).

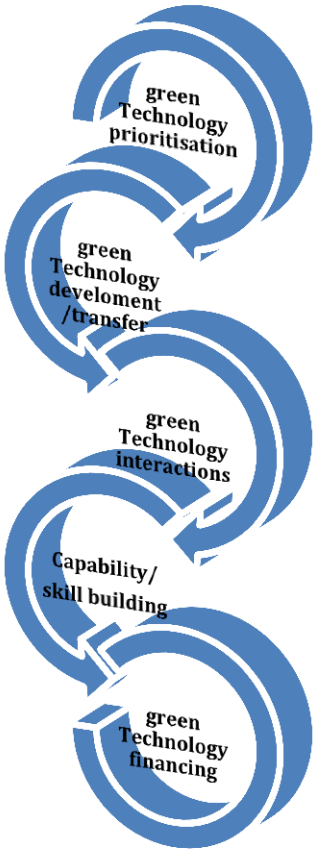

Figure 9: Schematic presentation of green technology system for the AU-GIF

a. Green technology identification and prioritization

Green technology identification and prioritization is critical first step for African Union and its Member States. This is because not all technologies are useful for the continent- i.e. some are feasible and beneficial economically, socially and environmentally while others can be detrimental in the same measure. It is important for the AU and its Member States to understand what is really relevant for the African continent. In this, identifying and prioritising green technologies at continental, regional and national level is critical so as to ensure that technological choices and investments in the same account for the economic, social and environmental aspirations of green growth. These technological priorities should be informed by national priorities under development visions and the Agenda 2063. The process of prioritisation requires adequate technology needs assessment/analysis mechanisms. To do this, investments in and/or strengthening existing green technology analysis systems

e.g. technology research hubs, centres of excellence, incubation centres is critical at continental, regional and national level to ensure that green technologies are identified and analysed for informed decision and investments. The green technology needs assessments should focus on addressing Africa's development sectors including mining, agriculture, energy, tourism among others while ensuring adherence to low-carbon emissions; resource-efficient technologies and spurring a shift towards green growth and sustainable development.[53] As a key output to this action, periodic green technology analysis report should be prepared by Member States, RECs and AU levels.

b. Green technology development and transfer

Upon understanding these technology needs, countries are expected to put in place mechanisms for developing these technologies by developing new ones or through technology transfer and adoption. Developing new technologies involves doing new things through new processes (where applicable): making risky investments in new/unfamiliar sectors or products; or adopting new/unfamiliar methods, processes, technologies, inputs or business models. All this depends crucially on the activity of entrepreneurs who drive change through their innovation and risk-taking ventures. At the continental level, the AU has made major steps towards establishing technology development and transfer platforms and initiatives that are relevant for its sustainable development aspirations, while its existing policies, strategies and frameworks provide a guide and opportunities for generating and testing new ideas across various sectors including energy, agriculture, health, transport, and water among others. These together with an updated framework on technology development and transfer will provide soft infrastructure that has enabled the identification of several dimensions of green innovation in Africa.

The existing soft infrastructure has motivated the establishment and development of new technology ideas currently thriving in the continents e.g. the boom in the renewable energy - such as the solar panel revolution and mobile banking systems. There is however need to invest more on hard infrastructure e.g. engineering solutions, technical solutions and physical infrastructure such as incubation centres, technology design and patent centres among others) to spur technology development and transfer at regional and national levels. To develop local technology development, more targeted investments is needed for national technology development centres, manufacturing centres- all linked to priority technologies. At regional level, continental technology development centres could be designed in ways that promote cross-country technology sharing, coordination and learning- taking advantage of emerging opportunities such as Africa Continental Free Trade Agreement (AfCFTA).

c. Green technology interactions

An interaction between various green technologies is core to green innovation. This enables the pursuit of the most innovative technological options/pathways with optimal benefits. Interactions can happen in three ways: technical interactions, outcome interactions or institutional interactions. Technical interactions involve various technical aspects of different technologies interacting to complement the efficiency of delivery e.g. solar water pumps. Outcome interactions involve interactions between outcomes of various technologies to produce optimal benefits from technologies e.g. reduced carbon emission through solar water pumps that support irrigation for food production. Institutional interactions imply that various institutions or sectors mandated to promote technological solutions can work together

[53] WEF (2015)

to pursue technological connections. These forms of connections ultimately helps create sectorial integration, technical innovation as well as institutional synergies- key aspects of technical, social and institutional innovations.

Africa Union and its Member states have so far succeeded in identifying some green technological solutions. However, these technologies are still fragmented across sectors. Green growth technologies outlined in the national green growth strategies of selected countries shows clear linkages between for example the energy, water and agricultural sectors (the so-called energy-water-food nexus). For example, Solar technologies that can generate energy for pumping water for agricultural production with enhanced water conservation and also provide lighting services at household level as well as provide opportunities for building innovative technological priorities with cross-sectorial effects in line with STISA-2024 priority areas, Agenda 2063 NDCs and SDGs.

Building on the technical identification and analysis options recommended earlier, the AU and its Member States could further invest in cross-sectorial technical groups, programmes, analytical tools and technological demonstration centres that scope green technological innovations across development sectors, tests and incubates existing and potential inter-linkages. Such inter-linkages could be within countries or cross-country i.e. through RECs levels.

d. Technical capability and skill building

The delivery of various sub-sets of green technology system requires specific skills across the various components of technology systems. Such skills and competences are necessary to perform the following: (i) undertake technology needs assessment and gap analysis, (ii) develop and implement both hardware and software platforms for technology transfer, (iii) analyse and understand the technical and outcome linkages between various green growth technologies across various sectors, and (iv) develop and implement enabling institutional arrangements and pursue green innovations both in terms of developing competitive green growth projects, programmes and initiatives as well as developing and interpreting innovative policy strategies.

To this end Member States need to undertake capacity building and skills assessment exercise to identify the type of skills required for various green innovation actions and also determine skill gaps that ought to be filled. Presently some of the AU Member States are putting in place a number of opportunities towards developing necessary skill sets. While these efforts are key, there is need for African countries to develop and enhance intra-Africa technical cooperation to grow skills and develop linkages for effective technology transfer. Again, emerging centres of excellence and institutions for capacity building such as Universities will need to be tailored for specific competencies including challenges and opportunities in relation to the SDGs.

4.2. Knowledge systems

As with conventional innovation, the knowledge system of any society is the bedrock of its innovation capacity and trajectory. Broader conceptual literature defines knowledge systems as “a network of agents, practices and institutions that organize the production, transfer and

use of knowledge".[54] Currently, knowledge systems in Africa occur in various forms with a lot of focus on knowledge production and sharing. At continental level, systems have been established to create knowledge networks and interactions e.g. the African Union Network of Sciences established under the AU-STRC aimed at facilitating interactions and knowledge sharing. The AU-GIF can immensely benefit from interventions that strengthen and re-orient these existing systems.

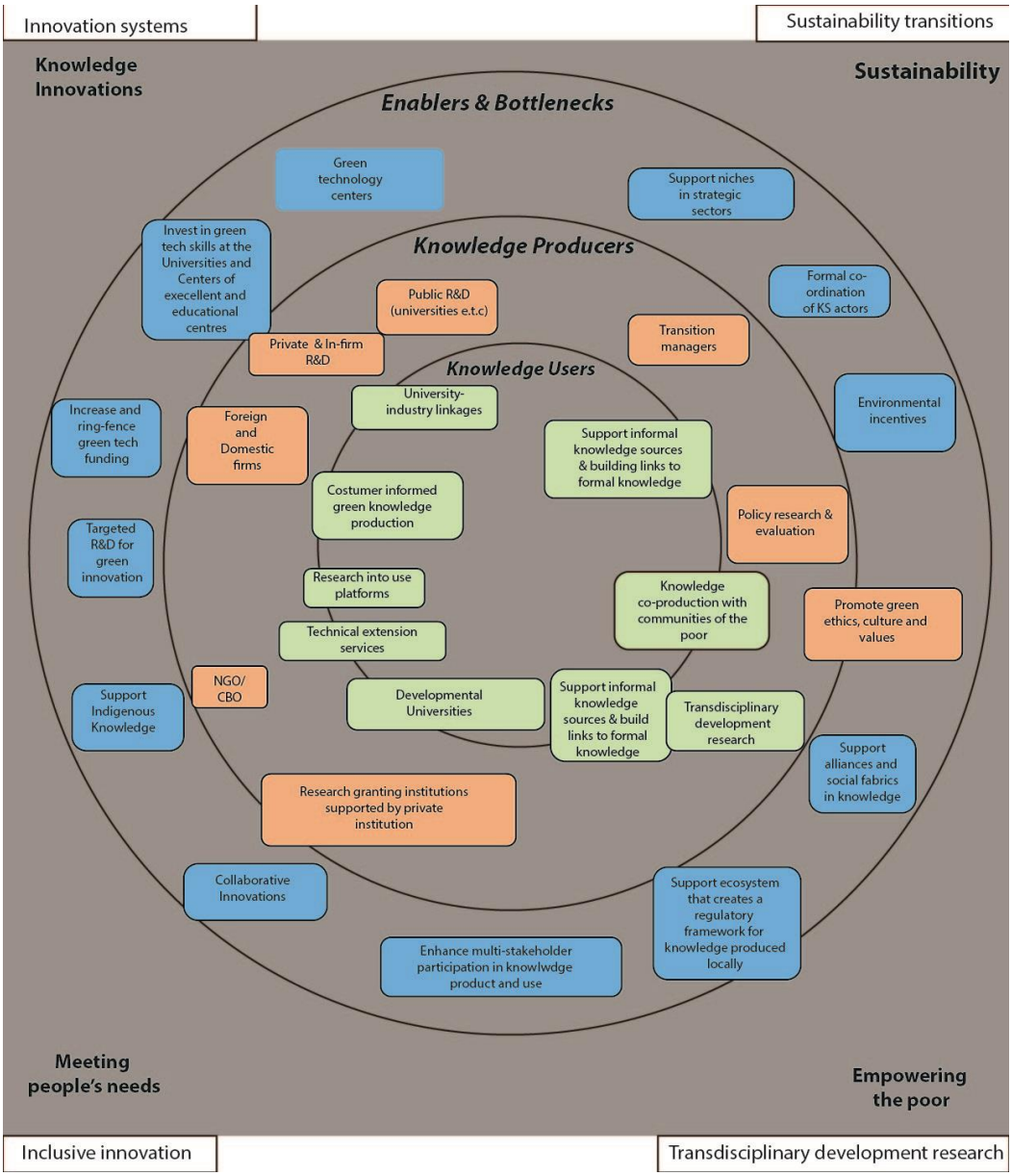

Figure 10: A framework for effective knowledge systems that can promote green innovation in Africa. Source: HLP

A comprehensive Knowledge System is presented in Figure 10 that based on experiences from various models and outlines how to build the linkages between knowledge producing systems (e.g. Universities, TVET systems, private firms, think tank systems among others)

[54] https://steps-centre.org/blog/how-can-knowledge-systems-in-east-africa-contribute-to-sustainable-development/

and knowledge use systems (e.g. knowledge into use frameworks, knowledge- linkages, knowledge networks etc) as well as what could enable this linkages (e.g. governance, institutional arrangements, investments, policies etc). These elements can help the AU, RECs and countries develop a system that helps to achieve various objectives including commercialisation and economic development, establishing sustainable systems, meeting people's needs and empowering the poor.

For the AU-GIF three key principles for strengthening knowledge systems at continental, regional and national levels are proposed: strengthening production and use of relevant knowledge, creating linkages between formal and informal knowledge for green innovation (Knowledge inclusion), and promoting interactions between various knowledge domains (disciplines).

a. ***Knowledge production and use***

Strengthening production and use of knowledge is key not only for investing/producing relevant knowledge but also ensuring that the knowledge (whether formal or informal) meets the needs of people. Africa is endowed with a number of knowledge producing platforms ranging from universities, public/private research organisations and think tanks, centres of excellence, private consultancy firms, international expatriates and agencies such as the UN among others. However, two issues stand out; first while there is reasonable amount of knowledge (e.g. publications, briefs etc.) produced on green growth, the aspect of green innovation options for countries and continent remain poorly researched. Second, the relevance of knowledge produced remains unclear due to lack of clear understanding of knowledge needs and linkages between knowledge production/investments and priority development solutions.

Therefore, investing in green innovation research and identifying research needs is key for Africa's green innovation. The AU and RECs is to work closely with pan-African think tanks to develop evidence hubs that could help identify relevant research needs and promote the gathering, analysis and interpretation of research knowledge in line with Africa's Green innovation needs, and aspirations.

b. ***Knowledge inclusion***

Knowledge drawn from research and other sources is critical for informing sustainable green growth actions and building technical and institutional capabilities towards implementing AU-GIF.[55] Knowledge can reside in both formal educational structures such as universities and is also found in informal settings including the local people and indigenous communities. Africa is endowed with both formal and informal as well as interdisciplinary knowledge. However, in most knowledge systems interventions, focus has been given to research and formal knowledge centres such as Universities. The informal sector plays a critical role in driving green innovation and green growth in the continent but has b not been given adequate recognition in the formal knowledge governance system. In other words, formal and informal have been dealt with in isolation with no framework for inclusion and linkage both at regional and national levels.

The AU-GIF proposes knowledge inclusion in two fronts: the need to develop framework for formal and informal knowledge linkages at the regional and national level. The framework

[55] OECD (2014)

should catalyse the uptake of the rich base indigenous knowledge by broader formal knowledge system to spur green growth. Countries such as Rwanda have developed policies e.g. the Rwanda Home grown policy- aimed at promoting indigenous knowledge and their integration with formal knowledge systems[56]. Second, is the need for strengthening inter-disciplinary linkages between social and physical sciences.

c. ***Promoting Knowledge interaction***

Knowledge production in the different domain of knowledge is pertinent and further interaction within the domain give an impetus to new knowledge and/or enhance existing knowledge for better use. The potency and significance of interdisciplinary knowledge has improved essence of life and humanity.

The AU-GIF needs to enhance knowledge interactions. This involves strengthening inter-disciplinary linkages between social and physical sciences as well as interactions between forms of knowledge i.e. formal and informal. The AUNS can play a significant role in promotion and interaction by developing clusters of research to address the interlinkages between different discipline that include the impact of Scientific research on communities needs and behaviour, and to advocate for intra and inter disciplinary research to form scientific nexus.

While there are efforts to promote such knowledge interactions, Africa faces a number of impediments including lack of adequate platforms for research and evidence synthesis to enhance both access and usability of knowledge; weak funding for knowledge production and use, poor coordination and institutional redundancies as well as lack of appropriate frameworks to enhance formal and informal knowledge sectors and their linkages.

4.3. People and Society

The green innovation is not only about technology but it is also essentially about morality and appreciation of people's way of life and societal values. To this end, African countries have documented a number of provisions that could promote integration of green innovations with people's way of life. These include constitutions which give people the right to clean and healthy environment; clean water and air Acts among others. While these are important, the existing systems in most cases fail to capture some of the informal norms, feelings, attitudes that are critical in driving individual actions. The AU-GIF proposes three key ways that could help spur green innovations: societal ethics and values; societal culture and norms; and social fabrics and gender mainstreaming.

a. Ethics and values

Ethics is central to achieving green innovation by instilling self and institutional morality and drive towards green innovation. Ethics can be viewed in various dimensions: professional ethics, personal ethics and institutional ethics. The AU-GIF considers ethical standards at individual or institutional level as crucial for green innovation. African countries have put in place transparency and accountability frameworks in line with the requirements of international green growth funds as well as green climate funds and other climate finance ethics. These mechanisms have worked well in entrenching transparency and accountability

[56] Atela et al. (2019): http://ksi.acts-net.org

at institutional level. However, two key areas need to be strengthened- the reinforcement of the transparency frameworks and the enhancement or promotion of equity, voice of the vulnerable in the decision process. At the continental level, the AU should to develop and environmental transparency and accountability guideline that defines on the relations between the different countries and their commitments to continental green growth agenda and developmental agenda. At the national level, countries will have to deal with reinforcing the existing frameworks including curbing corruption to avoid loss of green growth resources. Most importantly, countries will need to develop more proactive approaches such as to instilling moral values among its citizens so as to embrace accountability. Cultivating a culture of transparency and morality in handling public resources is a major enabler of the AU-GIF. This will ensure that resources set aside for green innovation are optimally utilised and not lost to corruption "corruption remains one of the greatest threats to innovation in Africa – as resources to grow innovative ideas are lost".

Further, green technology developers, investors and think tanks should promote transparency of information with their clients. For instance, farmers should be given the right to know the context for green innovations such as climate smart agricultural practices and be allowed to share in the information about potential implications and benefits. These practices need to be supported through appropriate legislations that supports disclosure, accountability and transparency. This is critical because green innovation actions are likely to shift rights (over resources e.g. land, minerals etc) and may create new opportunities and vulnerabilities in the same measure.

b. Culture and norms

The route of culture starts from attitude to habits and eventually becomes culture and with green is a similar trajectory. Green innovation as environmentally friendly innovation requires culture and norm structures that values conservation, lack of waste, sharing, reduction, reuse and recycling. Entrenching alternative values that promote environmental conservation and protection across all levels of society is viewed as foundational component of green innovation. As such, entrenching cultures and values that promote environmental conservation and protection across all levels of society is viewed as foundational component of green innovation.[57] Generally, culture determines how people see and interpret events, green technological transitions, as well as response. Historically, most citizens e.g. farmers have been handled more as recipients of development technologies, and have to depend on external actors for training and news of new technologies or projects. There is greater need for the green innovation solutions whether technology or policies be conscious of cultural context because such determines adoption and sustainability of green innovation ideas. Therefore, understanding the cultural aspirations and operations of citizens is critical in promoting the feasibility of green innovations. Indeed, there are indications that some of the innovations witnessed in Japan were due to a prevailing culture of collaboration, which was also sometimes described as their 'national character.'

c. Social fabrics and gender mainstreaming

Social fabrics refer to ways which the society is organized and how people relate to that organization. For instance, African people are highly connected through social fabrics around labour movement, livelihoods, and social networks among others. Green innovation should build on these systems to ensure success, buy-in and sustainability of the actions.

[57] Holden et al. (2015) & Tàbara et al. (2018).

Additionally, conscious efforts should be made to ensure that green innovation actions account for these social fabrics and in any case strengthen them where necessary and enhance where possible.

On the gender, women are found to be less in number in the field of engineering and technology in Africa and globally. Hence AU-GIF encourages and emphasizes the inclusion and mainstreaming of women in the development of green technologies and innovation. This should be considered at the continental, regional and national levels by designing programmes and projects the involves women. For instance, most of Africa essentially use firewood for cooking and indoor air pollution from such are detrimental to women who mostly cook. The green innovation and technologies in minimizing pollution and energy saving cooking stove are of great benefit to women and involving the women to partake in such technology development are of immense value to Africa.

4.4. Regional/National Institutional and Policy Enablers

The policy landscape for green economy in Africa is evolving quickly. As highlighted in the previous policy review 2.1 of this framework, this GIF is anchored on existing policy domains and aims to draw support as much. So far, there are several policy domains at global, regional and national levels that provide enabler for the AU-GIF. These ranges from 2030 SDGs and the Paris agreement at the global scale; the AU agenda 2063, AU Climate Change Strategy, Africa Industrialization Development Strategy, STISA-2024 and other development policies. At the national level, there already exist green growth strategies in different Member States as well as climate change – related provisions e.g. the Nationally Determined Contributions and most importantly, the national innovation frameworks under the Science Technology and Innovation Roadmaps. While these policies provide a supportive basis for the AU-GIF, they have not explicitly targeted green growth because of their differentiated target priorities. As such, the need for building on these existing policy opportunities to create a more targeted roadmap for green innovation is critical. As part of the AU-GIF, five main actions are proposed for consideration at regional and national levels: green innovation policy roadmap; institutional integration; research and evidence; information communication and technology; and political stability and goodwill.

a. Green Innovation Policy roadmap

The green innovation policy road map offers an opportunity to define the necessary legislations, laws that to pave the way for green innovation such as incentive system for green innovation and to direct existing investments and encourage new ones towards green innovation. Experiences in the OECD countries that include Japan, Australia, Norway, among others, shows that these countries have progressed in their GI through promoting innovation policy roadmaps supportive to innovation pursuit.

For instance, Japan developed an innovation roadmap that established new systems design, expanded environmental technologies and products and incentivise green actions. Similarly, Korea developed a policy roadmap in 2010 targeting Green Car Development that involved the introduction of a bonus-malus scheme and other incentives for consumers to purchases green vehicles in 2012. In addition, a tax incentive of up to KRW 3.1 million per vehicle is offered for the purchase of hybrid-electric vehicle (HEV). Norway developed a roadmap that encompasses incentives to promote the use of electric vehicles, EVs including the exemptions from the first-time registration tax, value added tax (VAT) and road tolls; reduction of the

annual motor vehicle tax; and permission to use road lanes otherwise reserved for public transport.

These strategies are also emerging in various African countries. For example, Kenya has established a VAT exemption on imported solar equipment. Already case indications show that such innovations underpin some success of Lighting Africa, especially triggering rapid development of new markets for solar portable lanterns in Kenya[58]. The case of mobile enabled payments for solar home systems (M-KOPA) in Kenya further demonstrates how policy innovation can create pathways to innovative market opportunities. MKOPA in Kenya is giving an increasing number of rural household's access to renewable energy (Solar Home Systems) via mobile payment systems. [59] The good pieces of legislations and incentives can be consolidated through a comprehensive green innovation policy road map at the national and AU level. These road maps aim to leverage on both national and regional opportunities to spur green growth.

b. Institutional integration

Institutions form the rules of the game, including formal and informal rules, norms and established practices that regulate and enables specific innovative actions in particular contexts and impose restrictions and/or barriers and trade-offs that ought to be made between various practices, technologies and actions. Institutional innovation involves two levels: horizontal integration involving creating inter-linkages between various green economy sectors, mandates and aligning skills; vertical integration involving linking national green growth systems to the regional and continental systems.

Through institutional integration plans, specialised committees should be set up to strengthen integration. At national level, sectorial/departmental technical committees should be established to promote cross-sectorial integration while at the AU level, an intergovernmental committee should help link the national systems to the AU green growth and other continental strategies. Institutional integration will require dialogues, consultations and evidence on opportunities.

Institutional innovation is also about integrating formal and informal institutions by nurturing positive green culture, value and ethics are core enablers that can be supported through robust national and regional GI institutional integration plans.

c. Research and Evidence

Evidence on what works or not -in line with the aforementioned technological innovation is critical. To this end, there is need for AU Member States to invest in Research and Development and more specifically, targeted empirical research on green technologies, their feasibility, adoption and scalability should be encouraged in different contexts. Additionally, empirical studies on what enables particular forms of innovations including documentation of best practices from elsewhere is key to informing progress on the GIF. The relevant empirical studies should not only focus on the technical feasibility of green innovation options but should further look into socio-technical feasibility including how best existing norms, cultures, histories could promote particular green innovation initiatives. Further research on the sustainability prospects and ways of enhancing the same is an enabler. Experience shows

[58] Ockwell D. and Byrne R. (2015)
[59] https://steps-centre.org/blog/how-can-solar-power-transformations-sustainability-kenya/

that most green technologies such as improved cooking stoves, solar home systems fail to be sustained because promoters often lack facts about ways of sustaining these technologies within prevailing local contexts - cultures, resources etc. Consequently, while most technologies get deployed, their sustained use is not guaranteed as users e.g. local communities often abandon such and revert to their original ways.

Countries will need to invest in green innovation research and evidence support. Such research should not be only premised on delivering academic publication and knowledge but packaging information in ways that can be applied to spur innovation. Again, it might not be just about commissioning new research and studies but also establishing inventories of existing knowledge and up-scaling best practices from such.

d. Information, Communication and Technology

The ICT is increasingly becoming a crosscutting area in all aspects of human and social endeavours. Its (ICT) role in enhancing green growth in the continent is inevitable. ICT enables GI through three main pathways: 1) ICT provides information thus creating awareness around green technologies, markets and opportunities- for instance many local communities in Africa e.g. Kenya and South Africa among other counties are now receiving information on climate smart practices and weather related insurance alerts through their mobile phones; 2) it helps in connecting different people and different technologies and associated opportunities thus enabling the linkages required for green innovation- for instance the, the inter-agency linkages through ICT in Rwanda and the application mobile money transfer technology at time of cash shortages in Zimbabwe are some examples; 3) ICT also provides opportunities for communication and sharing lessons and best practices.

Most digital platforms are currently being used as learning spaces where different stakeholders share lessons on best practices to enhance exchange and learning. African countries should therefore invest in ICT to enable green innovations. Some countries such as Rwanda are already investing in ICT as enabler of knowledge for its economic growth. The ICT is also aligned to the emerging Industry 4.0 (interchanged with 4th Industrial Revolution). Without being prescriptive, the AU GIF leaves Industry 4.0 engagements to the Member States level. The reason why this is left to the AU Member States is due to varying acceptance levels and contestations that Industry 4.0 brings up.

e. Political stability and goodwill

Finally, political stability and goodwill are prerequisites for effective implementation of the AU-GIF. Promoting political goodwill for green growth is paramount and a key enabler of any green innovation pursuit. According to the AfDB perspective of green growth in Africa[60], political buy-in of green innovation ideas is very fundamental to the success of green innovation. Understanding the political economy of green innovation i.e. what interests exists, what actors hold what view, which actor networks are able to unlock various political processes and other relevant opportunities among other- could help countries to unlock the necessary political goodwill. Further, sustainability dialogues needs to be harnessed and supported both within and across countries. These dialogues can be anchored at continental, RECs or national levels.

[60] AFDB (2011)

4.5. Green innovation fund

Like any frameworks and strategies, the successful implementation of the AU-GIF is highly anchored on the availability of adequate funding mechanisms that are based on traditional funding mechanisms and alternative source of funds. There are three critical funding windows AU-GIF should explore: First the Direct Access to Climate Finance which is obligatory to all Party that has signed and ratified the Paris Agreement. Unfortunately, most African countries lack capacity hence they rely on Third Party- the Overseas Development Assistants (ODAs) funding windows which is not sustainable. The second source of financing is the Indirect Access (Third Party) such as ODAs which is dwindling and not sustainable. The third is the domestic resource mobilization (DRM) such as Pension Fund, Sovereign Wealth Funds, Ecological Funds, National Adaptation Funds etc in this regard, concerted effort be made towards building capacity and ensuring that the accreditation of Africa's identified institutions for direct access to climate finance. In this regard, there is need to establish an independent funding mechanism is vital to achieve the aspiration of this framework. The funding is to be channelized through two main ways which are Technology and Knowledge funding.

On another note, technology financing is critical for building technology systems for green innovation. Currently, Africa (both at the continental and national levels) do not have clear cut (consolidated) technology finance mechanisms. Instead, the continent heavily relies on green technology imports with little home-grown development.

While knowledge financing is key enabler of knowledge systems through supporting production, dissemination and use of knowledge. In terms of formal research knowledge, African countries continue to hugely promote knowledge production through national funding mechanisms such as National Research Funds, however, the AU is yet to maximize on the existing funding mechanism for knowledge generation such as the African Union research grant. In addition, there are ongoing programme under the African Scientific Research and Innovation Council (ASRIC) and it resource mobilization strategy that includes utilization of the African Science Technology Fund ASTIF to dedicate part of its fund to the Green Technology and Innovation development in the continent, through the development of flagship projects that address this framework.

There is a need to establish the green innovation fund to support green technology development and knowledge production for the continent. This fund should operate as a trust/investment fund with diverse resources that includes African Union, international donors, private sector, cooperate social responsibility, charity among others, while there is a need to study the possibilities to launch green bonds. This fund should include diverse disbursement windows such as grants, loans, incentives.

Chapter 5: Implementation Plan for the AU-GIF

The implementation plan was developed considering the pre-requisite pillars and the sub-pillars that are identified earlier in chapter 4 of the framework. The implementation plan also was developed considering the following principles which are: shared responsibilities; national mainstreaming and regional integration; building on existing opportunities and creating new actions where necessary and potential areas of interventions. Table 1 is a comprehensive analysis for the implementation plan where key recommendations/actions were developed along with responsibilities of main stakeholders.

a. Shared responsibility

The implementation plan is designed in such a way that it provides an opportunity for various stakeholders to undertake certain specific actions that are legitimised by governments at the national level and the AU at the continental level. This means that while the political responsibility for the framework rests with the AU, RECs and African Member States the implementation of various actions is a shared responsibility among a diversity of stakeholders including think tanks, UN Agencies, Universities, donors among others.

b. National mainstreaming and regional integrations

At the AU level, the focus is to establish actions that would catalyse cross-country engagements, integrations and lessons sharing for technologies, financing, and knowledge among others. At the national level, the key actions are to strengthen and reinforce the existing frameworks and mechanisms through continental/regional actions such regional technology and financial systems. These regional inputs should aim to strengthen existing green growth strategies in the countries as well as create stronger linkages with associated policies such as those of climate change. The budgetary implications for each action will highly depend on how the proposed actions are entrenched.

c. Building on existing opportunities and creating new actions where necessary

The implementation of the framework is heavily anchored on existing opportunities. The recommended actions will involve strengthening existing institutions focusing on green growth and green innovation at national and regional levels. There are however new actions that have been recommended where such don't exist and are necessary to spur the framework.

d. Potential areas of interventions

In accordance with the pathway to green innovation in figure 3 (Pathways to green innovations) is classified into the following:

- Green Economy and Growth – this is when an economy of a continent, region or a nation deals with low carbon emission, resource efficiency and socially inclusive economic growth; in various economic and development sectors. This can only be applied in the different sectors of the economy depending on the prioritization of the AU Member State in according with their strategic economic/development plans which should address the following: Agriculture; Tourism; Energy; water; Waste management; Land use management; Building and construction; Manufacturing; Mining; and Urban development and Maga Cities development and structure among others
- Climate Change & Environmental Sustainability – this aspect fundamentally deals with maintaining the quality of environment without depletion or degradation of natural resources while interaction and activities continue. This will ensure today's need of the continent and the needs of the future generation. The adverse effect of the climate change

seems to be compromising sustainable use of the environment and measures must be put in place to ameliorate the effect. This also must be sectorial approach that are not limited to the ones mentioned above but sectors like health, population and forestry are to be considered.

- Blue Economy – this involves the sustainable use of ocean resources for economic growth and improved livelihoods while preserving the health of the ocean ecosystem. African has a coastal line 30,500 km in length and is bounded on the west by the Atlantic Ocean, on the East by the Indian Ocean and Mediterranean Sea, on the South by the mingling waters of the Atlantic and Indian Ocean this makes blue economy vital for the continent[61]. The potential aspect of blue economy must be exploited under this framework by the AU Member States: Marine life conservation and ocean; Protecting coastal line and communities form the impact of climate change; Reducing marine litters and pollution; Taking action against illegal fishing by using sustainable fishing policies; Harnessing renewable energy; Using smart ships on territorial waters to lessen the impact on the environment
- Eco-innovation – this aspect is at the centre of the AU-GIF that stands on the tri-partied push and pull for it to be successful. For eco-innovation to achieve success in the continent there must be: Technology push that will be determined by product quality, material efficiency, energy efficiency and etc; Market pull – that will be determined by market share, new market, competition, customer demand, image and labour cost; Regulatory push – existing environmental laws, standards developments and others

[61] https://www.britannica.com/place/Africa

Table 1: AU-GIF Implementation Plan

GIF Pillar and sub-pillar	Key recommendations/Actions	Rationale	Responsibility	Timeline	Funding sources
TECHNOLOGY SYSTEMS FOR GREEN INNOVATIONS					
Green technology identification and prioritization	- Establish regional technology analysis centres either as stand alones or anchored within selected Universities or Centres of Excellence or new centres e.g. technology research hubs, centres of excellence, incubation at regional and national levels - Mainstream green technology analysis in the existing national research and innovation centres.	Need for Africa and its Member States to understand what green technologies are really relevant for the African context.	-AU-STRC -Think Tanks -Universities -Regional and national Innovation Hubs -National Research and Innovation Centres -Specialised technical committees	2020-2023	- African Green Innovation Fund - AfDB - National budgetary allocations. - Private sector and industry - Development partners - World Bank, EU - Global Environment Facility (GEF)
Green technology development and transfer	- Establish regional green technology development centres in each RECs including hardware infrastructure e.g. engineering solutions, technical solutions and physical infrastructure such as technology design and patent centres among others) designed to promote cross-country technology transfer - Establish national green technology development centres, manufacturing centres- linked to priority technologies. - Strengthen national technology transfer platforms such as incubation centres - Anchor or link the technology development centres on the analysis centres.	- Technology systems in Africa dominated by software including policies and strategies. There is need to develop the hardware - Lack of regional green technology transfer and integration platforms	-AUC -RECs -Think Tanks -Universities -National Governments -Specialised tech committees -UN Bodies (UNFCCC, UNCTAD, UNIDO)	2020-2025	- Green Climate fund (GCF) - African Green Innovation Fund - AfDB - National budgetary allocations. - Private sector and industry - Development partners - World Bank, EU development - Development Partners - Charity donations Global Environment Facility (GEF)
Green technology interactions	- Build on the technology analysis centres recommended earlier, to	- Technological fragmentation across	AUC -RECs	2020-2025	- African Green Innovation Fund

.	develop effective analytical tools and technological demonstration centres that scope green technological innovations across sectors, tests and incubates the inter-linkages	sectors. There is need to package and implement integrated technological pathways within and across the sectors.	-Think Tanks -Universities -National Governments -UNFCCC -UNCTAD -UNFCCC tech unit-CTCN -UNIDO -Specialised tech committees		- AfDB - National budgetary allocations. - World Bank, EU development - Development Partners Global Environment Facility (GEF)
Technical capability and skill building	- Undertake capacity and skills assessment to identify the type of skills required for various green innovation actions and also determine skill gaps that ought to be filled. - Develop framework for intra-Africa technical cooperation to grow skills and develop linkages for effective technology transfer. - Tailor emerging centres of excellence and Universities targeting capacity building will need to be tailored for specific technical competencies. - Develop long term capacity building on green technology, research and financing – including trainings, exchange visits, secondments etc.	- Capacity and skills to promote technology analysis and development at national and regional levels is weak or not adequately supported.	-AU-STRC -Think Tanks -Universities -Centres of Excellence -National -RECs - -UN Agencies	2020-2030	- Green Climate fund (GCF) - African Green Innovation Fund - AfDB - National budgetary allocations. - Private sector and industry - Development partners - World Bank, EU development - Development Partners - Charity donations Global Environment Facility (GEF)
	-				
KNOWLEDGE SYSTEMS FOR GREEN INNOVATIONS					
Knowledge production and use for green growth	- Increase investments in R&D from 1% to 2% in line with the STISA 2024. Ring-fence a share of this for green innovation research - Develop/strengthen evidence hubs	- Need to enhance green innovation knowledge in the current knowledge bases. - Need to enhance	-AUC -RECs -Think Tanks -Universities -National Governments	2020-2030	- African Green Innovation Fund - AfDB - Global Environment Facility (GEF)

	at continental, regional and national levels that could help identify relevant research needs and promote the gathering, analysis and interpretation of research knowledge in line with Africa's needs, circumstances to enhance both access and usability of knowledge Strengthen knowledge coordination and learning platforms such as expert networks on green growth research and policy -	linkages between knowledge production and priority developmental needs.	-Specialised tech committees -UN Bodies (UNFCCC, UNCTAD, UNIDO)		- National budgetary allocations. - Private sector and industry - World Bank, EU development - Development Partners - Charity donations
Knowledge inclusion	- Develop framework for formal and informal knowledge linkages at the regional and national level. - Strengthen inter-disciplinary linkages between social and physical sciences. - Mainstream green growth research in the regional and national green technology centres.	- There is need for a programmes and frameworks for linking formal and informal knowledge systems so as to leverage optimal outcomes for green innovations	-AUC -RECs -Think Tanks -Universities -National Governments -Specialised tech committees -UN Bodies (UNFCCC, UNCTAD, UNIDO)	2020-2030	- African Green Innovation Fund - AfDB - Global Environment Facility (GEF) - National budgetary allocations. - Private sector and industry - Development partners - World Bank, EU development - Charity donations
	-	-			
PEOPLE AND SOCIETY					
Ethics and values	- Develop continental (at AU level) environmental transparency guideline that defines the relations between the different countries and their commitments to continental green growth agenda as well as financial transparency and accountability mechanisms. - Reinforce existing transparency and accountability frameworks at national level including curbing corruption to avoid loss of	- There is need to reinforce the transparency and strengthen equity, voice of the vulnerable in the decision process	-AUC -RECs -Think Tanks -Universities -National Governments -Specialised tech committees -UN Bodies (UNFCCC, UNCTAD, UNIDO)		- African Green Innovation Fund - AfDB - Global Environment Facility (GEF) - National budgetary allocations. - Private sector and industry - Development partners

	green growth resources. - Develop and embrace more proactive approaches towards instilling moral values among citizens e.g. green stewardship awards and incentive programmes, awareness and learning, morality mentorship programs among others. - Promote transparency in information and rights to prior and informed consents on green innovation interventions				- World Bank, EU development - Charity donations
Culture	- Understand and align the cultural aspirations and operations of citizens with green innovation actions at continental, regional and national levels to enhance feasibility, adoption and sustainability of green innovation ideas. - Strengthen frameworks for promoting indigenous knowledge systems and promoting value addition on the same.	- The greater need for green innovation solutions whether technology or policies be conscious of cultural context. - Culture defines people's way of life and interpretation of green actions.	-AUC -RECs -Think Tanks -Universities -National Governments -Specialised tech committees -UN Bodies (UNFCCC, UNCTAD, UNIDO)		- National budgetary allocations. - Private sector and industry - Development partners - World Bank, EU development - Development Partners - Charity donations
Social fabrics and gender mainstreaming	- Reinforce or establish (where they don't exist) regional and national social protection programmes at RECs and national levels. - Establish social safety nets to cushion vulnerable groups from negative impacts from green innovation actions - Mainstream gender considerations in green innovation actions at all levels.	- African people are connected through social fabrics around labor movement, livelihoods, and social networks and green innovations should build on these social fabrics for success.	-AUC -RECs -National Governments -UN Bodies (UNFCCC, UNCTAD, UNIDO) - Civil Society- NGOs		- Green Climate fund (GCF) - African Green Innovation Fund - AfDB - Global Environment Facility (GEF) - National budgetary allocations. - Private sector and industry - World Bank, EU development - Development Partners - Charity donations

REGIONAL/NATIONAL ENABLERS – POLICY AND STRATEGIES					
Green Innovation Policy roadmap	- There is need to strengthen linkage between continental (AU) STI framework (STISA 2024) and the green innovation and climate change framework with the national green growth, innovation and climate change policies. - Support countries to develop national green innovation policy at national levels Green innovation policy roadmap to strengthen the	There is need to establish a strategic policy roadmap that galvanises various environmental actions e.g. under climate change towards green growth.	-AUC -RECs -Think Tanks -Universities -National Governments -Specialised tech committees -UN Bodies (UNFCCC, UNCTAD, UNIDO)		- African Green Innovation Fund - AfDB - National budgetary allocations. - Private sector and industry - Development partners - World Bank, EU development - Charity donations
Institutional integration	- Horizontal institutional integrations: Enhance institutional integrations among various relevant departments through inter-agency green growth committees, promoting communication channels between environment/green growth and fiscal agencies. - Vertical institutional integration: Strengthen the linkage between AU innovation framework with national framework through clear mainstreaming, engagements and coordination actions.	- Fragmented agencies handling green innovation is an impediment to Africa's realization of green growth. - Institutional innovation is not only about integrating formal institutions but also enhancing informal ones supported through robust national and regional GI policy roadmap	-AUC -RECs -National Governments -Specialised tech committees		- African Green Innovation Fund - AfDB - Global Environment Facility (GEF) - National budgetary allocations. - Private sector and industry - Development partners - World Bank, EU development
Research and Evidence	- Establish coordination and exchange platforms to enable sharing and learning	- Evidence on what works or not -in line	-RECs		- African Green Innovation Fund

	among countries. - Commission targeted empirical research on green technologies, their feasibility, adoption and scalability should be encouraged in different contexts. - Additionally, empirical studies on what enables particular forms of innovation	with the aforementioned technological innovation is critical.	-Think Tanks -Universities -Specialised tech committees		- AfDB - Global Environment Facility (GEF) - National budgetary allocations. - Private sector and industry - Development partners - World Bank, EU development
Political stability and goodwill	- Undertake periodic political economy analysis to understand the political economy of green innovation i.e. what interests exists, what actors hold what view, which actor networks are able to unlock various political processes and other relevant opportunities - Sustainability/green growth dialogues needs to be harnessed and supported both within and across countries and anchored at continental, RECs or national levels.	- Political buy-in of green innovation ideas is very fundamental to the success of green innovation.	-AUC -RECs -National Governments -UN Bodies (UNFCCC, UNCTAD, UNIDO)		- African Green Innovation Fund - AfDB - National budgetary allocations. - Development partners - World Bank, EU development - Charity donations
Financing of the AU-GIF					
Green Innovation and Technology	- Establish regional green technology trust fund to support green technological assessment, development and implementation - Mobilize diverse funding windows including international donors, private sector, cooperate social responsibility, green bonds to contribute to the fund. - AU-STRC to be registered as an accredited entity to mobilize fund on the behalf of AU Member States. - Establish a trustee for the funds management e.g. regional development Bank (AfDB) to work closely with the AU and RECs in inclusive management and disbursement of funds.	- The continent lacks established green technology financing mechanisms. Need a technology finance fund linked to the global technology funds such as CTCN and the UNFCCC Technology financing.	-AUC -National Governments -UN Bodies -International partners -Private sector	2020-2030	- Green Climate fund (GCF) - African Green Innovation Fund - AfDB - National budgetary allocations. - Private sector and industry - Development partners - World Bank, EU development - Development Partners - Charity donations - Global Environment Facility (GEF) -

	- African Science, Technology and Innovation Fund (ASTIF) - The AU-STRC to launch Calls that addresses climate mitigation and adaptation , blue economy, green economy, environmental sustainability, eco-innovation among others				
Knowledge	- Establish regional green-innovation research fund- can be synchronised with the green technology fund. - Set aside a share of national research funds to specifically address green growth knowledge production and also strengthen their structural linkages to promote utility. - Establish public private sector partnership e.g. University-Industry linkages to enhance private sector investments in knowledge production - Redirecting African Union Research Grant to fund green innovation research - The African Union Network of Sciences (AUNS) to ensure the availability on domain on knowledge interaction on green innovation and technology	- National research funds exist at national level. There is need for a green innovation research fund at the AU (Continental level).	-AUC -RECs -Think Tanks -Universities -National Governments -Specialised tech committees -UN Bodies (UNFCCC, UNCTAD, UNIDO)	2020-2030	- Green Climate fund (GCF) - African Green Innovation Fund - AfDB - Global Environment Facility (GEF) - National budgetary allocations. - Private sector and industry - Development partners - World Bank, EU development - Development Partners - Charity donations -

Chapter 6: Enablers for the implementation plan

The implementation plan of the framework is based on four key enablers: 1) specialised implementation committees; resource mobilization and support; stakeholder engagement and advocacy; monitoring evaluation and learning system; as shown in figure 11; Four key actions have been proposed as central to implementing the AU GIF namely: (i) Mainstreaming and Readiness; Advocacy, (ii) Publicity and Uptake; (iii) Resource Mobilisation; and (iv) Knowledge Creation and Sharing (Fig. 11).

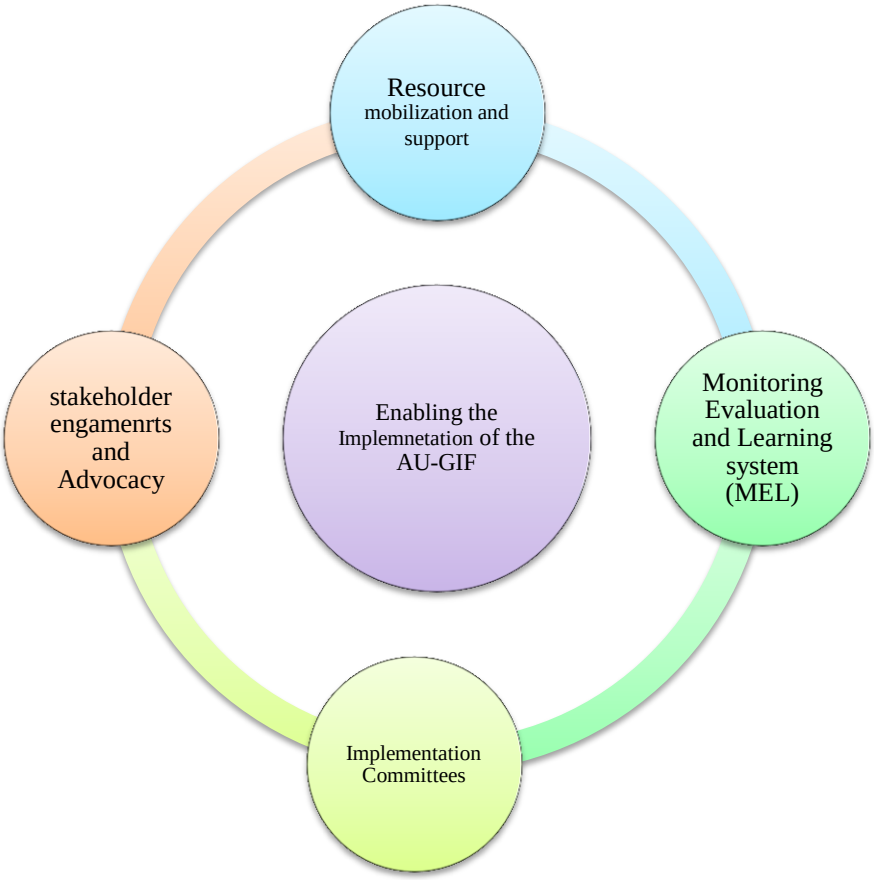

Figure 11: AU GIF implementation enablers

5.1. Specialized implementation committees

The establishment or setting up of specialised implementation units committees within ministries, department or agencies at national and regional level is key to driving the implementation plan. The committees anchored on various AU Agencies i.e. the AU-STRC will help to put in place an AU GIF Implementation Panel made up of relevant experts to help oversee the implementation as well as the monitoring, reporting and verification (MRV) of the AU-GIF. The Implementation Panel to be appointed by the AUC to support AU Member States in implementing the AU-GIF and to mobilise resources for the same. The Implementation Panel will have its Secretariat established at the AU STRC. The key roles of the specialised committees shall include the following:

- Supporting resource mobilization through the GCF and other funds,

- Support Member State to mainstream the AU-GIF framework into their green growth policies and national innovation systems,
- Support knowledge generation and research to reinforce and provide evidence to the AU-GIF,
- Support readiness and capacity building programmes for AU member states,
- Support Advocacy and Publicity of the AU-GIF across the AU, Regional Economic Commission (RECs), its development and donor community as well as member states, and
- Any other strategic function that may be useful for the implementation of the AU- GIF.

5.2. Resource Mobilization and support

Resource mobilisation for the AU-GIF will target to generate adequate financial, human and infrastructural resources to support the implementation process. Various options are proposed for mobilising resources as outlined in Table 2. The role of multilateral and international agencies is important in the regard. However, it is important to note that mobilising budget allocations should prioritise domestic resources.

Table 2: Options for mobilising the AU-GIF resources

Financial Resources	Human Resource	Infrastructural Resources
✓ Draw from the stakeholder mapping to identify key donors and their needs- DFID, GIZ, DANIDA, ✓ Development of Investment Proposal for the GCF and other relevant funds ✓ Donor roundtable and bilateral discussions ✓ Establish Green Innovation Trust Fund to help implement AU-GIF – country donations, grants	✓ Expert networks – AUNS ✓ Capacity identification ✓ Capacity audits ✓ North – South networks	✓ National Innovation Hubs ✓ Regional Innovation Hubs ✓ National Laboratories ✓ Regional Laboratories ✓ Centers of Excellence –

5.2.1. Financial resources

These are monetary resources required to facilitate the implementation of the AU GIF. Financial resources will be mobilised through the following options:

- Lobbying for budget allocation from the national budgets.
- The development of investment proposals or business case for the green innovation ideas; drawn on aligned national green growth strategies - these proposals will be marketed to various private sectors players including industries to lobby for their investments.

- Pursue GCF opportunities – this will be done through two options; pursuing regional accreditation for AU STRC and also through lobbying for regional project funding to support regional projects.
- Pursuing bilateral discussions and roundtables with specific donors including Africa Development Bank, World Bank, European Commission and various development Aid Agencies (DFID, DANIDA, NORAD, SIDA, IDRC, GIZ among others).
- Establish Green Innovations Basket Trust Funds with countries encouraged to establish a fund portal to specifically draw in resources. The fund can be supported by seed funding from national budgetary allocation which will then be opened up for contributions from different sources including grants, companies through their corporate social responsibility funds, philanthropists, among others. Rwanda's FONERWA remains a good example and/or starting point to assist in building such trust funds.
- Public-private partnerships.
- Mobilising funds from various climate change, environmental and development funds. Most of these funds can be accessed through well designed government programmes. Examples of such funds include:
    a) Private Sector Facility (PSF)
    b) The Adaptation Fund
    c) Global Environment Facility (GEF)
    d) The Least Developed Countries Fund (LDCF)
    e) The Special Climate Change Fund (SCCF)
    f) Climate Investment Funds (CIF)

5.2.2. Human resources

These include skills and capabilities required to implement, evaluate and improve the AU GIF like:

- Engaging Africa based expert networks (e.g. AU STRC Scientist networks, Africa Sustainability Hub Expert Society, among others) to identify relevant skills for specific actions and needs.
- Engaging centres of excellence and universities to identify and engage most appropriate skills required for the implementation of AU GIF.
- Undertake periodic capacity audits to identify the rights skills.

5.2.3. Infrastructural resources

These are resources that provide equipment base for facilitating the implementation of AU GIF nationally and regionally. These resources will be mobilised mainly through existing infrastructures within the following options:

- National Innovation Hubs where innovative ideas are nurtured and supported. Most countries have established such hubs and could be used to support green innovation ideas and skills. Examples include the *Buni* hubs in Tanzania, the TVETS in Rwanda and the Climate Innovation Centre in Kenya.
- Incubation Centers – these are centers established to help test and nurture technologies. There are several private and public incubation centers in the continent which could be used to promote technology transfer and adoption.
- National and regional research laboratories such as those for medical research, agricultural research, among others are to be utilized/incorporated.

- Centers of Excellence established at various African Universities through the support from the World Bank and other international agencies. These could offer specialised trainings and capacity building on various aspects of GIF.

5.3. Stakeholder engagement and Advocacy

The successful implementation of any policy initiative and its related programmes is dependent on the balancing the views and opinions of individuals, groups and organisations with interest in such initiatives. These are the stakeholders and their impact on policy or programme formulation and implementation varies within and between them. This variation and its implicit tensions and conflicts make stakeholder analysis an important if not indispensable undertaking of a policy cycle particularly in democratic societies. This is because stakeholders determine the success or failure policies, programme and frameworks initiative. Identifying relevant actors in the policy-making space is the essence of stakeholder analysis. Stakeholder engagement will be activated both at continental and national level with the aim of creating adequate political buy-in and ownership of the framework as well as leveraging on the various opportunities (financial, human resource, infrastructure etc.) presented by various stakeholders.

Actors in each of these groups operate at different levels at the global, continental, regional economic communities, national and sub-national levels. The stakeholders play different roles ranging from funding, knowledge creation and public support including citizen participation in the process. The strategic roles of these stakeholders need to be well understood and harnessed for the success of the AU-GIF. The AU-GIF will put in place periodic stakeholder engagement systems both at country and continental levels.

Advocacy and publicity is equally critical to establish the legitimacy of the framework among AU Member States, RECs, Member States and other key stakeholders including the media. This will involve championing for a high-level buy-in across spatial levels and institutions, political, technocrats, and professional bodies among others. The publicity builds on the stakeholder mapping. The mapping indicates the roles, responsibilities and value various stakeholders can bring into the process. In the short term, the framework is publicized through keynote pitches at various high-level consultative forums that enrich the information and development of the framework. In the intermediate phase, a popular version of the framework is developed and used to create awareness about the framework. Additionally, a special launch event for the framework is organised to help legitimize the framework among Member States, donors and other stakeholders. The longer-term uptake strategies involve mainstreaming the GIF in the education curriculum, placing the framework in key Africa's libraries, knowledge repositories and continuous policy dialogues.

5.4. Monitoring Evaluation and Learning System

Upon putting in place implementation structures, countries need to develop a robust and easily adoptable Monitoring, Evaluation and Learning (MEL) framework. The MEL framework will be developed at the AU level and at the Member States level. The regional framework will seek to monitor how the AU- GIF 2030 is being mainstreamed including how many countries have enacted policies, how many have invested in technology systems among others. The continental MEL will also be used as a tool for convening countries for sharing experiences and lesson learning. The AU- GIF 2030 implementation committee will work with the guidance of AU-STRC to develop this continental MEL while relevant country Ministries will be guided in developing national MELs. The MEL will ideally identify

activities, indicators, outputs, milestones and outcomes at continental and national levels. Currently, most African countries lack appropriate monitoring and reporting systems that could track impacts and provide feedback on green actions. The continent faces some challenges in development green tracking. These include lack of adequate data and empirical information to inform the development of indicators, lack of adequate information on the linkages between the national green growth outcomes with broader continental and global goals such as SDGs and climate change (MDG Assessment report).

Recently, there have been increasing efforts to develop indicators to enhance tracking of green outcomes thereby linking up with the Big Data revolution required in the SDGs era. Such efforts include utilizing increased consultative platforms on SDGs such as the annual seedbed transformation networks bringing together stakeholders to identify opportunities and challenges for tracking SDGs, the Africa Sustainability Hub (www.ash-net.org) working on the various pathways to sustainability based on socio-technical dialogues. The continental partnerships are deployed with new SDG tools such as the experiences of SDG-labs across different sectors and regions ranging from crop production initiatives in Western Africa (CSIR Crops Research Institute); to waste management initiatives in East Africa; pioneering citizen science in Southern Africa; and supporting wedged fisheries post-projects activities in Madagascar as well as renewable energy in East Africa.

Apart from continental initiatives, there are several international partnerships working on linking national actions to global goals. The UN Partnership for SDGs[62] currently brings together different partnerships to engage and inform SDG progress in different ways. The Partnership has established Country chapters that engages at country level and feeds to the global level. Ultimately countries need to tap into these opportunities and distill various indicators and trajectories relevant to their context. However, such MVRs can immensely benefit from continuous empirical research on what works or not and associated sustainability prospects.

[62] https://sustainabledevelopment.un.org/partnerships/about#criteria

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Glossary

Various terms have been used to explain or identify green growth and green innovation. These include sustainable development, 'institutions' 'actors' 'blue economy' eco-innovation among others. This glossary therefore outlines working definitions for such terms as applied in this framework.

African Union Green Innovation Framework (AU-GIF): This (AU-GIF) is the central aspect of this report and is articulated as a guide to catalyse the efforts of and between African countries towards green growth through promoting societal and economic resilience to environmental pressures, a greater efficient use of natural resources and achieve the aspirations of Agenda 2063 and the sustainable development goals as envisioned by the United Nations.

Blue Economy: The blue economy refers to the opportunities in harnessing the potential of water bodies i.e., oceans, seas, lakes and rivers to improve livelihoods, enhance resilience and achieve sustainable development.

Eco-innovation: Eco-innovation refers to all forms of innovation - technological and non-technological - that create business opportunities and benefit the environment by preventing or reducing their impact, or by optimising the use of resources.

Green economy: refers to an economy that reduces environmental risks and ecological scarcities, through low carbon, resource efficient actions that aims for sustainable development without degrading the environment.

Green growth: This framework defines Green growth as interventions that promote economic growth and development while significantly reducing environmental risks and ensuring that natural assets continue to provide the resources and environmental services for development. Green growth entails a green economy that is growing over time and space.

Green innovation (GI): This framework defines Green innovation (GI) as the creation and implementation of new or significantly improved technologies, markets and institutional arrangements, which lead to environmental improvement, social wellbeing and economic prosperity. GI is viewed as a critical enabler in achieving sustainable development and for Africa.

Innovation: Innovation is widely viewed as a way of enhancing competitiveness in technology, markets and organisation (including institutions and policies). Innovation entails doing things differently including creation of new markets or products and services, and value networks that adds value to or replaces the established ones.

Institutions: This framework adopts a combination of definitions drawn from both political ecology and political economy perspectives to define institutions as formal and informal rules as well as interactions among actors involved in making and implementing these rules within particular socioeconomic contexts

Nationally Determined Contributions (NDCs): These are mitigation and adaptation commitments and actions countries have outlined in line with the Paris Agreement.

Stakeholders: This framework adopts the definition provided in the earth system governance framework and the policy process analytical framework to define stakeholders as individuals, organisations and groups involved in decision making on a particular policy regime.[63]

Sustainable development: This framework adopts the definition by the World Commission on Environment and Development (WECD) that defines sustainable development as

[63] Biermann et al., (2010).

‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ [64]

[64] WCED, (1987:43)

Annex 1

Criteria for selecting innovative green growth technologies

Innovation criteria	Description
Novelty of the idea i.e. is it an existing/on-going or new creative idea?	• The level to which an idea is novel i.e. new from the normal ways of solving problems or improves the normal/existing ways of solving problems
Business viability of the idea	• Is the priority area able to attract investment from private sector as well as public private partnership initiatives and other funding opportunities e.g. climate financing?
Cross-sectorial linkages and policy coherency	• Does the idea integrate various sectors in its design, implementation and impacts? • How coherent are the priority ideas with national, regional and international green growth/climate change policies?
Practicality of the project idea	• How feasible or practical is the idea in the context of prevailing national, and local circumstances?
Replicable/Transferability of the idea to other context	• Is the project idea transferrable from one context to another to enable up scaling
Impacts and outcomes (environmental, economic and social)	• What environmental, economic and social benefits can be drawn from the technological options/ sectorial priority in the short and long run? • Do these benefits include all cadre of stakeholders in the society including gender, youth and disabled? • How do these impacts align to the STISA 2024 strategic orientation such as poverty eradication, disease control, wealth creation and social cohesion?
Sustainability	• What is the likelihood of sustaining the environmental, economic and social benefits of the project over many years to come? • How is the idea aligned to the SDGs?