



**The KENYA INSTITUTE for PUBLIC  
POLICY RESEARCH and ANALYSIS**

# **Assessment of Institutional Structures Governing Science Technology and Innovation in Kenya**

**Clement Otindo  
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**THE KENYA INSTITUTE FOR PUBLIC POLICY  
RESEARCH AND ANALYSIS (KIPPRA)**

**YOUNG PROFESSIONALS (YPs) TRAINING  
PROGRAMME**

# **Assessment of Institutional Structures Governing Science Technology and Innovation in Kenya**

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Kenya Institute for Public Policy  
Research and Analysis

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## **Abstract**

*Science, Technology and Innovation (ST&I) are key for economic transformation of a country and, as such, institutions are necessary for development and promotion of ST&I. Kenya has thus focused on institutional frameworks (policies, legal, and institutions) to govern the ST&I sector and facilitate promotion of ST&I in achieving the country's development agenda. As such, the country identified ST&I as an enabler to achieving economic transformation of 10 per cent annually through its mainstreaming in agriculture, industry and services sectors of the economy. This study therefore sought to review institutional frameworks and map out institutions guiding ST&I in Kenya using institutional analysis approach modified from Institutional Framework by Ostrom. Some of the gaps identified in the study included ST&I policy framework not fully adopted as it is still a draft; unsustainable funding for ST&I; weak coordination between the various agencies involved in ST&I; no working framework for technology transfer and commercialization; and weak linkage between innovators and the market and the industries for prototypes. Based on these findings, there is call for fast-tracking the adoption and implementation of the ST&I policy framework. NACOSTI and NRF could consider engaging key institutions owning ST&I policy with a view to increasing the funding for ST&I and revitalize and strengthen coordination between NACOSTI, KeNIA and NRF. KeNIA could develop and implement a proper framework for technology transfer and commercialization, and consider creating mechanisms that link innovators with prototypes to markets and industries.*

## **Abbreviations and Acronyms**

AU	African Union
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GERD	Gross Expenditure on Research and Development
IAD	Institutional Analysis and Development
ICT	Information Communication and Technology
IPRs	Intellectual Property Rights
KENIA	Kenya National Innovation Agency
KENRI	Kenya National Research Information
KYEOP	Kenya Youth Employment Opportunities Project
MTP	Medium-Term Plan
NACOSTI	National Commission for Science Technology and Innovation
NRF	National Research Fund
PCT	Patent Cooperation Treaty
PPP	Purchasing Power Parity
R&D	Research and Development
S&T	Science and Technology
SDG	Sustainable Development Goal
ST&I	Science, Technology and Innovation
STEM	Science, Technology Engineering and Mathematics
STISA	Science, Technology and Innovation Strategy for Africa
SWOT	Strength, Weakness, Opportunity and Threat
TVET	Technical and Vocational Education and Training

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## 1. Introduction

Science, Technology, and Innovation (ST&I) play a key role in creating sustainable economic growth and improving standards of living through technological development and innovation, the production and use of knowledge and the creation and adoption of new products. Given the importance placed on Science, Technology and Innovation, a country needs to put in place functioning institutional structures that govern its implementation.

Institutions play a key role in shaping the economic growth and development of any nation. According to North (1991), institutions are humanly devised constraints that shape human interactions “the game of the rules,” which provide a framework that shapes political, social, and economic organizations. He further argues that constitutions, laws, and rules govern formal institutions. Kristen (2009) states that first-party enforcement of the rules is carried out through self-imposed codes of conduct, or by second parties through retaliation, or by third parties through law enforcement. Therefore, the institutional structures are established laws, customs, practices, and relationships that guide a community or a society and are recognized as an essential part of the culture, business, or organization.

Brousseau and Glachant (2008) states that institutions are significant in maintaining the rule of law, promoting development programmes and activities, protecting property rights for individuals and businesses, and operating sound macroeconomic policies. Institutions determine economic growth by ensuring that available resources are equally distributed to all citizens and provide policing and effective justice systems that adhere to the given rules and regulations, thus institutions’ redistributive role cannot be ignored (Brousseau and Glachant, 2008). In every nation, a well-managed economy with an enabling business environment implies proper functioning institutions. For this study, institutions are conceptualized as the laws, policies, and regulations that govern the ST&I sector.

Science, Technology, and Innovation (ST&I) is a broad concept that can be defined by decomposing it into its constituent components. Science refers to the process of acquiring skills and knowledge. Technology is the application of the acquired skills and knowledge in industries and daily lives while innovation refers to the adoption of new processes, ideas, and behaviours. ST&I is fostered by strengthening institutions, funding Research and Development (R&D), investing in education and ST&I-related infrastructure, formulating, and enforcing Intellectual Property Rights (IPRs).

Science, Technology, and Innovation are ingredients to the expansion and diversification of the productive base of a country and they provide the potential



for employment growth. Science, Technology, and Innovation are interrelated in that innovation is born out of science-based technological progress and at times from the acquisition, adaptation, and diffusion of existing technological knowledge. Furthermore, entrepreneurial activities could lead to a new and or efficient combination of resources resulting in innovation. The ST&I sector have undergone various transformations as a result of globalization and socio-demographic changes, especially in areas of research and development, policy and strategy, science, and education.

Technological development and innovation, that is the production and use of knowledge together with creation and adoption of new products, are key ingredients to creating a sustained economic growth and improved standard of living. These aspects are critical in the socio-economic progress, trade competitiveness and development of any nation (UNCTAD, 2019). Production and application of knowledge are key in attainment of different Sustainable Development Goals (SDGs), including poverty reduction.

Technology transfer across and within the national boundaries is critical for technological knowledge and innovation. Transfer in this context is a collaborative and complex process where knowledge and information move in several directions. Technology transfer occurs when there are enough incentives to commercialize a given technology in a new location through licensing, trading products or even investing. These transfers usually occur through trade, foreign direct investment (FDI) and movement of professionals. The major avenues of transmission of technical knowledge across different countries is through trade and FDI; as such, their impact on technology transfer is not easy to separate (UNCTAD, 2019).

The Government of Kenya has recognized the role played by ST&I in transforming the economy, reducing poverty and increasing the country's competitiveness, both in the international and regional trade. Various government policy documents have documented the role of ST&I in the country's development. Kenya's Constitution in Chapter Two 11 (2)(b) recognizes the role played by science and indigenous technology in development of a nation. The ST&I Act of 2013 establishes three key institutions whose mandates are aimed at mainstreaming ST&I in the value chain.

Sustainable Development Goal (SDG) No. 9 identifies investment in innovation and infrastructure as key drivers of economic growth and development (United Nations, 2021). Furthermore, progress in technology is important in developing long-term solutions to economic challenges, such as the provision of new jobs. To facilitate sustainable development, there is need to promote sustainable industries and invest in scientific research and innovation. The SDG Agenda 2030, which was adopted in September 2015. was consistent with the continental African Union (AU) Agenda 2063 adopted in January the same year.

As such, aspiration one of the AU Agenda 2063 calls for a prosperous Africa that is based on inclusive growth and sustainable development. Further, goal No. 2 of the aspiration aims at achieving a well-educated African citizenry through education and skills revolution based on science, technology, and innovation. This continental goal was to be mainstreamed into national development goals and plans as outlined in the Science, Technology, and Innovation Strategy for Africa (African Union, 2020).

The Kenyan government has mainstreamed Science, Technology, and Innovation Strategy for Africa (STISA) in the Vision 2030 and its subsequent implementation through the Medium-Term Plans (MTPs). Science, Technology, and Innovation (ST&I) are identified as a key enabler to Kenya's Vision 2030 development goal through enhanced skilled labour force, technological advancement and increased employment opportunities. As a result, it is expected to stimulate technological and industrial transformation. This will culminate into social well-being and sustained economic growth reaching 10 per cent per annum, thus propelling Kenya to a competitive and prosperous middle-income country with a high quality of life.

To achieve this, the government implemented the Kenya Vision 2030 through the Medium-Term Plans (MTPs). Medium-Term Plan I was implemented between 2007-2012, Medium Term Plan II was implemented between 2013 and 2017, while Medium-Term Plan III is implemented between 2018 and 2022. To achieve the 10 per cent annual GDP growth, MTP III targeted to increase real GDP annual growth from an average of 5.5 per cent achieved over the 2013-2017 period to 7 per cent by end of the Plan period (Kenya Vision 2030, 2018).

During implementation of the third medium-term plan, the key programmes earmarked for implementation in the ST&I sector include the establishment of national science technology and innovation parks and the Science, Technology, Engineering, and Mathematics (STEM) Education Programme. Similarly, the sector targets to increase research funding to 2 per cent of GDP and attain a Global Competitiveness Index rank of 85 out of 137 countries by 2022 (Kenya Vision 2030, 2018).

Science Technology and Innovation (ST&I) are identified as a key enabler to Kenya's Vision 2030 development goal. It is expected to contribute towards the achievement of the Vision 2030 through enhanced skilled labour force, technological advancement and increased employment opportunities. To transform the ST&I ecosystem in the country, the Government of Kenya has initiated several progressive changes. Key among them is the enactment of the ST&I Act of 2013, which repealed the Science and Technology Act of 1977, bringing in the aspects of innovation. This move would ensure commercialization

of technology, which would then lead to economic development. Moreover, to ensure promotion, coordination and regulation of the ST&I, quality assurance, regulation, funding and advisory mandates, three key institutions (National Commission for Science, Technology and Innovation - NACOSTI, Kenya National Innovation Agency - KeNIA and National Research Fund - NRF) were created through the ST&I Act 2013 with distinct mandates.

These ST&I policy, legal and institutional frameworks are expected to jointly work towards stimulating technological and industrial transformation. This would then lead to social well-being and sustained economic growth reaching 10 per cent per annum. For such to be achieved, there is need to mainstream ST&I into the three sectors of the economy (agriculture, industry, and services).

Despite the important place accorded to STI in achieving a country's economic transformation, there is minimal efforts towards implementing national ST&I priorities. For instance, Kenya is yet to achieve a rank of 85 in the Global Competitive Index as it ranked position 95/141 globally in the 2019 Global Competitive Index Report (WEF, 2020). Moreover, the current level of funding for research and development is about 0.8 per cent against a 2 per cent as stipulated in the ST&I Act 2013, and against 1 per cent as indicated by the Science, Technology and Innovation Strategy for Africa.

Therefore, some of the identified bottlenecks that have resulted in low levels of ST&I mainstreaming in the sectors include weak harmonization of legal, institutional and regulatory framework. Furthermore, the policy framework is supposed to precede the Act; however, the ST&I Act of 2013 is at the implementation phase while the ST&I policy remains a draft. Similarly, some of the institutions' mandates have not been fully implemented as NACOSTI is still developing regulatory frameworks guiding the ST&I sector. This study, therefore, aims to critically review the institutional frameworks guiding ST&I in Kenya, map out the institutions guiding ST&I in Kenya, their roles, linkages and identifying gaps and opportunities that can be exploited to steer the country towards economic transformation.

As such, the rest of the paper is structured as follows: section 2 discusses the Science, Technology and Innovation in Kenya while section 3 reviews both theoretical and empirical literature on institutional structures governing Science, Technology and Innovation. Section 4 of the paper discusses the research approach and the data used in the study. Section 5 presents the findings of the study while section 6 provides the conclusion and policy recommendations of the study.

## 2. Science, Technology and Innovation: Stylized Facts

Kenya ranked position 95/141 in the Global Competitive Index report. The index is defined as a set of institutions, policies and factors that determine the level of productivity. In the institutions pillar, the country ranked 68th position over 141 countries reviewed globally, with future orientation of government (government ensuring policy stability, government’s responsiveness to change, legal framework’s adaptability to digital business models, government long-term vision among others) indicator ranking position 45/141. Mauritius ranked position 52nd, South Africa 60th, Morocco 75th, Seychelles 78th, Tunisia 87th, Algeria 89th, Botswana 92nd, Egypt 93rd and Namibia 94th in Africa ranking Kenya position 10 in Africa and 5th in Sub-Saharan Africa (World Economic Forum, 2019). This was a drop from the previous overall ranking of 93rd/140, with institutions ranking 64th globally and future orientation of government indicator ranking 28th/140. In 2018, Kenya ranked position 7/34 in Africa and 3rd in Sub-Saharan Africa after Mauritius 49th, South Africa 67th, Seychelles 74th, Morocco 75th, Botswana 90th, and Algeria 92nd (World Economic Forum, 2018).

Regarding the Global Innovation Index, in 2021, Kenya ranked 85/132 globally with institutions ranking position 8<sup>th</sup> globally and political environment, regulatory environment, and business environment ranking position 98, 80 and 60, respectively. In Africa, Kenya ranked 5<sup>th</sup> after Mauritius (52<sup>nd</sup>), South Africa (61<sup>st</sup>), Tunisia (71<sup>st</sup>) and Morocco (77<sup>th</sup> and 3<sup>rd</sup>/26 in Sub-Saharan Africa after Mauritius and South Africa (WIPO, 2019). In 2020, the country ranked position 86/131 from the previous position of 77/129 in 2019. Kenya achieved institutional ranking of 78/131 globally, with variables of political environment ranking 97<sup>th</sup>, regulatory environment 79<sup>th</sup> and business environment 60<sup>th</sup> overall. Mauritius, South Africa, and Tunisia were top performers in Africa, with Kenya ranking position 4<sup>th</sup> continentally and 3/26 in Sub-Saharan Africa (WIPO, 2020). The country thus improved with a +1 globally and maintained position 60 in business environment.

**Table 1.1: Global Innovation Index performance indicators**

Indicator	2020		2021	
	Score	Rank out of 129	Score	Rank out of 131
<b>Regulatory environment</b>	60.300	79	60.100	80
Regulatory quality*	35.800	89	36.300	94
<b>Research &amp; development (R&amp;D)</b>	4.500	77	4.500	78
Gross expenditure on R&D, % GDP	0.800	47	0.800	48
<b>Innovation linkages</b>	33.400	31	29.400	35

Indicator	2020		2021	
	Score	Rank out of 129	Score	Rank out of 131
University/industry research collaboration <sup>†</sup>	51.500	36	46.800	49
GERD financed by abroad, %	0.400	5	0.400	6
<b>Knowledge absorption</b>	26.200	73	25.900	68
Intellectual property payments, % total trade	1.200	29	1.700	16
High-tech imports, % total trade	9.400	40	8.200	58
ICT services imports, % total trade	0.300	118	0.400	111
Research talent, % in business enterprise	11.400	61	11.400	62
<b>Knowledge creation</b>	13.800	67	14.600	65
PCT patents by origin/bn PPP\$ GDP	0	83	0	82
Scientific and technical articles/bn PPP\$ GDP	6.700	69	11.100	77
Citable documents H-index	15.400	53	15.900	52
<b>Knowledge impact</b>	17.900	90	23.700	86
Computer software spending, % GDP	0	77	0.100	77
High- and medium-high-tech manufactures, %	9.600	83	11.100	85
<b>Knowledge diffusion</b>	23.600	65	25	45
Intellectual property receipts, % total trade	0.600	25	0.600	27
<b>Intangible assets</b>	23.100	83	24.100	89
Trademarks by origin/bn PPP\$ GDP	32.600	74	24.600	82
Industrial designs by origin/bn PPP\$ GDP	1	71	0.700	81
ICTs and organizational model creation <sup>†</sup>	60	44	60	44
<b>Online creativity</b>	0.500	124	2.300	131
Mobile app creation/bn PPP\$ GDP	0	92	0	103

Source: Author's compilation from the Global Innovation Index (2020 and 2021)

Based on the Global Innovation Index indicators, Kenya's position in key indicators fell in 2021 compared to the ranks in 2020. Kenya's rank in the regulatory environment fell from position 79 in 2020 to 80 in 2021, innovation linkages rank fell from 31 in 2020 to 35 in 2021. Research and development (R&D) fell in rank from 77 to 78 and online creativity from 124 to 131 in 2021.

Science, Technology and Innovation in Kenya is governed by institutional structures dating back to 1977 when the government enacted the Science and Technology Act Cap 250 of 1977. The Science and Technology Act 1977 focused mainly on science and technology. The ST&I Act of 2013 repealed the S&T Act of 1977, bringing in the aspects of innovation. The ST&I Act of 2013 then established key organizations, including the Kenya National Innovation Agency (KeNIA), to develop and manage the Kenya National Innovation System, National Research Fund (NRF) to mobilize, allocate and manage financial resources for the Kenya

National Innovation System to create knowledge, innovation and development in all fields of ST&I, and National Commission for Science, Technology and Innovation (NACOSTI) to regulate and assure quality in the ST&I sector and to advice government on matters on ST&I.

Chapter 5 of the Lagos Plan of Action of 1980 required member States to take measures towards provision of financial resources for purposes of promoting research and development in science and technology and, as such, Kenya established the NRF. Moreover, the country is developing the ST&I policy framework in relation to the Lagos Plan of Action Chapter 5(122) (b), which requires member States.

For any country to move up the value chain, the innovative activities involved depends on a wider system that comprises diverse actors and their interaction, and the policy framework guiding different policy domains. Nationally, the innovation system shapes the countries development and innovation performance, therefore the government acts as the glue that holds innovation systems together to ensure that all the actors work cohesively and complement each other in achieving the goal to the national growth (UNCTAD, 2019).

National innovation ecosystems are economic engines that create new ideas while at the same time scales up the existing innovation with high potential. These systems provide the web of support that makes it easier for innovative start-ups to launch and grow quickly, and for already established organizations to pivot and innovate more aggressively. The major components of the desired national innovation system include the demand for science, technology and innovation, research and education system, the business system, intermediate organization, the ST&I infrastructure, the framework conditions and the governance systems (Kenya National Innovation Agency, 2018).

Within this ecosystem, the government actors provide the conducive policy, legal and regulatory environment for ST&I that creates the incentives, infrastructure and the skills that are necessary to engage in innovative activities. The government sets appropriate policies and regulations that provide guarantee to firms that the returns on their investment in innovation are secured. Moreover, the government also has the responsibility of ensuring that the educational system is responsive to industries' needs and provides the finances required to build the national infrastructure for research and development (R&D). Above all, the government as an actor also oversees the formulation and implementation of ST&I policies and facilitates interactions between key actors and institutions in the National Innovation System (UNCTAD, 2019).

Other actors within the ST&I ecosystem include: (i) firms and entrepreneurs who have the capabilities to learn, absorb, innovate and commercialize new knowledge and technologies with an effect on innovation; (ii) the user/consumers who have the capabilities to learn, test, and adopt new technologies; (iii) research and education system with the capabilities of learning, absorbing and developing new applied knowledge and supplying human capital to the ST&I system and then; (iv) industry, with the capability to absorb the different innovative ideas and link research and education system.

Kenya's national innovation system is characterized by the existence of many actors that work together to ensure a dynamic interaction and contribute to the effectiveness of the innovation system. The country has about 20 research and development institutions, 31 public chartered universities, 7 public university constituent colleges and about 30 private universities, several TVET institutions, several technology support and regulatory agencies, and about 38 commercial banks.

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### **3. Literature Review**

#### **3.1 Theoretical Literature**

##### **3.1.1 Institutional theory**

Institutional theory underscores the role of the societal context in understanding both the individual and organizational behaviour (Thornton and Ocasio, 2008). It views institutions as the main source of organizing principles that govern individual and collective action, normally drawn close with organizations (Scott and Davis, 2006). Therefore, based on this analogy, institutions are not merely physical places or even organizations, but social and cultural structures, norms, and relationships that are resistant to change (Scott, 2001).

Historical institutionalism argues that once policies are adopted, and organizations created, those structures will persist until a major event occurs that will disturb the equilibrium (Steinmo, 2008). It assumes that institutions are maintained through positive feedback that is received by participants because of existing policy outputs. The theory argues that institutions are more open to change and contain within themselves sources of change. Institutions influence governance in that they present the interaction of structures and the governance process (Steinmo, 2008).

The interaction of the ST&I legal, regulatory, and institutional framework with the actors, who are engaged in decision making (governance process) produce economic development. Through institutions, ST&I is mainstreamed in the three sectors of the economy that have been identified to steer employment creation among the youth, thus contributing to the economic development of the country.

#### **3.2 Empirical Literature**

##### **3.2.1 Policy review and institutional analysis**

Mwami and Matwere (2019) examined the institutional structure of the informal sector in Kenya based on institutional analysis and policy review. The results indicated that institutional structures governing the informal sector were fully explained by institutional analysis approach, as it helped in understanding the role actors and institutions in MSEs play in implementation of operations and in identifying constraints that undermine policy implementation. Using desk review of the policies, laws and institutional structures, and SWOT analysis, the results supported the institutional analysis approach. The study concluded that there was need to channel resources and efforts towards development of a coordination strategy, training and capacity building strategy, lobby for more funding from



private and development partners resources, and establish key institutions to improve informal sector productivity towards employment creation.

Kivoi (2021) critically reviewed public participation legal frameworks initiatives at national and county levels in Kenya using desk review of the Constitution and public participation legal frameworks (Bills, Acts and Policies) to identify gaps, conflicts and challenges impeding the success of public participation. The study concluded that even though several Acts have been enacted and policies developed, there are obstacles into operationalizing them and as such implementation is the main challenge to public participation in Kenya.

National Information Platform for Food Security and Nutrition (NIPFN) in 2021 reviewed policies guiding food security and nutrition and use of evidence in improving human nutrition in Kenya. Desk review of 48 policies, 14 legislative and 7 regulatory frameworks on food security were conducted covering a period between 1980s and 2021. Themes adopted in this study included food production and availability, food safety standards and quality control, food access, promotion, nutrition awareness, improvement and environment, vulnerable groups and coordination. The results presented using themes indicated that there existed policy gaps in the implementation of interventions.

UNTCAD (2011), reviewed the ST&I capability and assessed how such capabilities were translated into innovations to help steer the economy into middle-income. The results indicated the need for policy action in promoting ST&I development to achieve sustainable growth and development. The study reviewed organizations, institutions, policies and linkages characterizing Ghana's innovation system. Desk review was conducted based on SWOT analysis of the innovation system, policy regime, and institutional arrangements necessary for a dynamic system of innovation. Also, the performance of research and development and potential for ICT, food and agro-processing, traditional and herbal medicine sectors were reviewed. These formed the themes used in the analysis. Coordination and implementation of ST&I policy, ST&I implementation strategy and linkage between public and private sector actors were identified as the opportunities in the ST&I sector.

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## **4. Methodology**

### **4.1 Introduction**

This section outlines how the study was undertaken, including how the objectives were addressed through the collection of various data. Objective one was addressed using the institutional analysis approach of policies and legal frameworks guiding the ST&I sector, while objective two was addressed by mapping out the key institutions governing the ST&I in Kenya and identifying the gaps that could be leveraged to achieve their specific mandate. The third objective was answered by undertaking a Strength, Weakness, Opportunity, and Threats (SWOT) analysis of the ST&I sector.

### **4.2 Research Approach**

Institutional analysis of different legal and regulatory frameworks guiding the development of ST&I in Kenya was undertaken. The institutional analysis incorporates the legal and regulatory reviews, which are particularly important in providing a comprehensive understanding of institutions and institutional arrangements when several actors are involved in different but related activities. The importance of this approach is its relevance in understanding how different actors in the Science, Technology, and Innovation sector and their modalities of operations, mandate, policies, legal and regulatory frameworks affect the implementation of policies guiding the sector.

Institutional analysis is a participatory approach used in assessing the capacity, behaviour, interactions, and outcome of actors that carry out development activities. This approach also helps in identifying constraints that may undermine policy implementation within and across the organization. According to Mburu (2017), this approach is useful in assessing the capacity, interactions, behaviour, and outcomes of organizations that carry out development activities. Moreover, the approach also assists in identifying constraints that may undermine policy implementation across organizations. This approach was adopted in this paper to review policies and regulatory frameworks guiding the ST&I sector in Kenya.

According to Leach et al. (1999), robust legal and regulatory frameworks are essential to achieving a balance that favours sustainable development. The flexible nature of the institutional framework by Ostrom has made it possible to fit into context analysis adoption by the author. A study by Mwami and Matwere (2019) designed a conceptual framework from the Institutional Analysis and Development framework (IAD) framework to illustrate that the outcomes realized from any

form of governance are based on both institutions and how those institutions interact with the enforce mechanisms.

The basic structure of the IAD framework as modified from Ostrom, Gardner and Walker (1994) involves an exogenous set of variables, situations of actors, and the behaviour of actors in those situations leading to outcomes, which then feeds back into modifying the actors, the exogenous variables and their situations. This framework investigates the factors affecting the structure of the action arena by looking at the inter-relationship among actors, institutions and their activities and resources (Aoki, 2001).

According to Kristen et al. (2009), although the sequence of institutional analysis does not necessarily follow a linear model, it is interactive and cumulative. As such, one element impacts the other directly or indirectly. These interactions involve economic, political, and social relations. High-level institutions are resistant to change and include the laws and regulations.

The core aspect of the framework is the identification of the action domain defining the spheres of activity and interest of the analysis. This comprises the institutions to be analyzed, the activities that the institutions are engaged in, and the actors in the institutions and activities (Aoki, 2001). Within this framework, the most important part is the identification of institutions, their activities, and actors that play roles in the action domain. However, the structure and behaviour of the action domain is not solely determined by the elements within, but is set in and affected by a wider environment (physical and infrastructural, economic and policy and governance). The interaction among actors, institutions and activities involves actions that then leads to outcomes (Dorward and Omamo, 2009).

This study reviewed the interactions between legal and regulatory frameworks that guide ST&I in Kenya. In doing so, the legal frameworks on the establishment of ST&I institutions were examined. Similarly, the regulatory frameworks were also examined on how they operationalized the regulations of the established institutions (NACOSTI, NRF, and KeNIA).

### **4.3 Data Sources**

The data for this analysis was obtained from different institutions, including the National Council for Law Reporting, NACOSTI, Kenya National Innovation Agency, National Research Fund, Ministry of ICT, Innovation, and Youth affairs. Data was collected through desk review involving policies, legal frameworks and institutions that govern the ST&I sector. Secondary data sources included the policy and legal framework put forward by the Government of Kenya to govern the operationalization of the ST&I sector. Some of the key documents reviewed

included Acts and sessional papers. The analysis covered opportunities that if pursued could steer the success of ST&I flagship projects, weaknesses, and threats that impede the success of the ST&I sector preventing the attainment of the 10 per cent annual growth and global and regional positioning of the country.

## **5. Findings**

### **5.1 Institutional Analysis**

This section will review the institutional framework, including policies and legal documents and the institutional structures (NACOSTI, KeNIA, and NRF) that support the ST&I sector in Kenya. This paper adopted the institutional framework to constitute policies and legal documents. As such, sessional papers and Acts of Parliament were reviewed focusing on the objectives, what has been done, and the existing gaps.

#### **5.1.1 Policies guiding ST&I sector in Kenya**

The ST&I policy framework envisioned to be developed and implemented during the MTP III period (2018-2022) is currently a draft, although it was reviewed to align it with the Science Technology and Innovation Strategy for Africa during the 2018/2019 fiscal year. Achievements under the policy framework (sessional papers) include the re-adjustment of ST&I projects by aligning them to MTP III through development of five National Research Priorities.

Furthermore, Kenya attained a global competitive rank of 95/147 in 2018/19 fiscal year against the 85/135 rank envisioned by 2022. The country also attained a rank of 5/25 in Sub-Saharan Africa and 10/34 in Africa against the mapped most competitive country in Africa. In addition, three centres of excellence were established at Moi University (Centre of Excellence in Phytochemicals Textiles and Renewable Energy), Egerton University (Centre of Excellence in Sustainable Agriculture and Agribusiness Management) and Jaramogi Oginga Odinga University of Science and Technology (Sustainable Use of Insects as Food and Feeds) and National Science, Technology and Innovation parks established at Konza Technopolis and Dedan Kimathi University of Science and Technology. Based on the findings from Table 5.1, the gaps that have been identified in the policy framework include the development and implementation of the ST&I policy framework, the adoption of ICT in curriculum delivery, achievement of the most competitive country in Africa and inadequate and unstable funding of the ST&I.

**Table 5.1: Policies guiding ST&I in Kenya**

Policy	Objectives	Focus on ST&I	What has been done	Gaps
Sessional Paper of 2012 on A Policy Framework for Science, Technology, and Innovation	<ul style="list-style-type: none"> <li>To re-adjust ST&amp;I projects to national goals and market needs to recognize sector needs and decide the essential technology platforms needed to address those needs</li> <li>Recognize and foster key industries including manufacturing, ICT, energy, transport, agriculture, and space science that will assist the country with accomplishing its middle-income country status</li> <li>Support, re-structure and set up ST&amp;I organizations to make them more compelling in addressing national priority needs to assemble a powerful national innovation system that utilizes product-oriented multi-disciplinary approaches to become globally competitive</li> <li>Reinforce management and governance of the ST&amp;I sector and institutions to make them more effective and efficient responsible for performance</li> <li>Develop and implement a mechanism for sustainable funding of ST&amp;I</li> </ul>	<ul style="list-style-type: none"> <li>Revitalize and harness Science, Technology, and Innovation in Kenya</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of three key institutions (NACOSTI, KeNITA and NRF) through enactment of the ST&amp;I Act of 2013</li> <li>ST&amp;I projects have been re-adjusted to MTP III by developing National Research Priorities</li> </ul>	<ul style="list-style-type: none"> <li>The policy is still in draft even though some components have already been implemented</li> <li>Sustainable funding for ST&amp;I has not been achieved</li> </ul>

Policy	Objectives	Focus on ST&I	What has been done	Gaps
<p>Sessional Paper No. 9 of 2012 on The National Industrialization Policy Framework for Kenya 2012-2030</p>	<ul style="list-style-type: none"> <li>To enable the industrial sector attain and sustain a growth rate of 15% per annum</li> <li>To make Kenya the most competitive and preferred industrial investment destination in Africa</li> </ul>	<ul style="list-style-type: none"> <li>Creating an enabling environment that promotes and sustains a vibrant, globally competitive and diversified industrial sector</li> </ul>	<ul style="list-style-type: none"> <li>Kenya has attained a global competitive rank of 95/147 in 2018/19 financial year</li> <li>Attained a rank of 5/25 in Sub-Saharan Africa and 10/34 in Africa</li> </ul>	<ul style="list-style-type: none"> <li>Kenya is yet to achieve a rank of 85/137 in Global Competitive Index and the most competitive in Africa</li> </ul>
<p>Sessional Paper No.1 of 2019 on A Policy Framework for Reforming Education and Training for Sustainable Development in Kenya</p>	<ul style="list-style-type: none"> <li>To address macroeconomic and social challenges impeding the transformation to a knowledge-based economy through creation of technology platforms for enhanced productivity and growth</li> <li>To set up globally competitive skills development programmes for youth employability contributing to national development goals by strengthening Technical and Vocational Skills Development (TVSD)</li> <li>To formulate, review and implement appropriate policies, legal and institutional frameworks for the sector</li> <li>To integrate ICT in curriculum delivery and management in education and training</li> </ul>	<ul style="list-style-type: none"> <li>Transformation to a knowledge-based economy</li> </ul>	<ul style="list-style-type: none"> <li>Three centres of excellence established at Moi, Egerton and Jaramogi Oginga Odinga University of Science and Technology</li> <li>National Science, Technology and Innovation parks established at Konza Technopolis and Dedan Kimathi University of Science and Technology</li> </ul>	<ul style="list-style-type: none"> <li>ICT has not been fully integrated into the curriculum delivery</li> <li>KYEOP set to improve youth employability between 2018/19 to 2022/23 has trained 36,431 youths against a target of 70,000</li> </ul>

### **5.1.2 Legal frameworks governing ST&I in Kenya**

The legal framework governing ST&I in Kenya has evolved with time since the establishment of the Science and Technology Act of 1977. The Act was later repealed with the establishment of the ST&I Act of 2013. However, the research institutions that were set up under the S&T Act of 1977 were to operate under the new ST&I Act and registered as if they were created by the new ST&I Act 2013. To ensure regulation of ST&I, quality assurance, funding, promotion and advisory linkages, three distinct yet interrelated organizations were created through the ST&I Act of 2013. The National Council for Science and Technology was revitalized to the National Commission for Science Technology and Innovation (NACOSTI) and two other institutions, Kenya National Innovation Agency (KeNIA) and the National Research Fund (NRF) established. Moreover, the Industrial Property Act of 2001 established the Kenya Industrial Property Institute (KIPI), which is essential in promoting innovativeness in Kenya. The provisions of these Acts are outlined in Table 5.2.



**Table 5.2: Legal frameworks governing ST&I in Kenya**

Act	Provision
Science and Technology Act No. 3 of 1977	<ul style="list-style-type: none"> <li>• Established key research institutions including:                             <ul style="list-style-type: none"> <li>- Kenya Agricultural Research Institute</li> <li>- Kenya Industrial Research and Development Institute</li> <li>- Kenya Marine and Fisheries Research Institute</li> <li>- Kenya Medical Research Institute</li> <li>- Kenya Trypanosomiasis Research Institute</li> <li>- Kenya Forestry Research Institute under the Fifth Schedule, section 14(a) for the coordination of research and experimental development</li> </ul> </li> <li>• Established National Council for Science and Technology under section 3(1) to offer advice to the Government on all matters relating to the scientific and technological activities and research</li> </ul>
Industrial Property Act No. 3 of 2001	<ul style="list-style-type: none"> <li>• Established Kenya Industrial Property Institute under section 3 with the mandate to:                             <ul style="list-style-type: none"> <li>- Consider applications for and grant industrial property rights</li> <li>- Screen technology transfer agreements and licenses</li> <li>- Provide to the public, industrial property information for technological and economic development</li> <li>- Promote inventiveness and innovativeness in Kenya</li> </ul> </li> </ul>
Science, Technology, and Innovations Act No. 28 of 2013	<ul style="list-style-type: none"> <li>• Established National Commission for Science, Technology, and Innovation (NACOSTI) under section 3(1) to regulate and assure quality in the Science, Technology, and Innovation sector and to offer advice to the Government in matters related to ST&amp;I</li> <li>• Established Kenya National Innovation Agency under section 28(1) to manage the Kenya National Innovation System</li> <li>• Established National Research Fund under section 32(1) to facilitate research for the advancement of science, technology, and innovation</li> <li>• The research institutes established under the Science and Technology Act of 1977 continued to operate as if they had been accredited under the ST&amp;I Act of 2013</li> </ul>

### **5.1.3 Institutional structures of ST&I**

Towards transforming the STI system in Kenya, the government has taken several steps in creating effective institutional structures for ST&I through a number of initiatives. For instance, prior to the enactment of the ST&I Act of 2013, which brought in the aspects of innovation, Kenya's system was anchored on the Science and Technology cap 250 of 1977. With the integration of innovation into the system, commercialization of technology was then seen as viable with the potential of enhancing economic development.

Several organizations are involved in the implementation of ST&I in the country including universities, research institutions, private organizations and different government ministries. For this analysis, the focus was on the key institutional structures set up by the ST&I Act of 2013. These include the National Commission for Science, Technology, and Innovation (NACOSTI), Kenya National Innovation Agency (KENIA) and the National Research Fund (NRF).

**Table 5-3: Organizations involved in ST&I**

Organization	Legal framework	Mandate	Achievement	Gaps
<p><b>National Commission for Science, Technology, and Innovation (NACOSTI)</b></p>	<p>Science, Technology and Innovation Act 2013</p>	<ul style="list-style-type: none"> <li>Regulate and assure quality in the Science, Technology, and Innovation sector</li> <li>Advise the Government in matters related to ST&amp;I</li> </ul>	<ul style="list-style-type: none"> <li>Developed guidelines on research licensing and institutional affiliation (21 research institutions registered)</li> <li>Developed a manual for registration of research institutions in Kenya</li> <li>Created a research licensing portal</li> <li>Developed an ST&amp;I Strategy template to be used by the MDAs</li> <li>Held several ST&amp;I conferences</li> <li>Developed National Research priorities in collaboration with other stakeholders</li> <li>Developed Kenya National Research Information System (KENRIS)</li> </ul>	<ul style="list-style-type: none"> <li>There is weak coordination between the various agencies involved in ST&amp;I</li> <li>More focus on production and less focus on dissemination of research outputs</li> <li>Lack of national strategy for STEM education</li> </ul>
<p><b>Kenya National Innovation Agency (KENIA)</b></p>		<ul style="list-style-type: none"> <li>Develop and manage Kenya National Innovation System. Therefore, the Agency co-ordinates, promotes and regulate the National Innovation Ecosystem</li> </ul>	<ul style="list-style-type: none"> <li>Created the National Innovation Awards to recognize and honour Kenya's leading innovators to stimulate and encourage innovation in national priority areas (Food and Nutrition Security, Affordable Housing, Manufacturing, Universal Health Coverage, and Academic Research and Development)</li> <li>Established Innovation Academy to build innovative capacities of interested individuals and support integration of innovative practices into institutions</li> </ul>	<ul style="list-style-type: none"> <li>The Agency has not fully nurtured various innovative ideas to the adoption stage</li> <li>No working framework for technology transfer and commercialization</li> <li>Weak linkage between innovators and the market and the industries for prototypes</li> </ul>
<p><b>National Research Fund (NRF)</b></p>		<ul style="list-style-type: none"> <li>Facilitate research for the advancement of science, technology, and innovation by mobilizing, allocating and managing financial resources for effective National Innovation System</li> </ul>		<ul style="list-style-type: none"> <li>2% of GDP funding as outlined in the ST&amp;I Act has not yet been achieved</li> </ul>

The National Commission on Science, Technology, and Innovation (NACOSTI) was established to regulate and ensure quality in the ST&I sector. The Kenya National Innovations Agency (KENIA) was established to develop and manage National Innovations System (NIS), while the National Research Fund (NRF) was established to mobilize, allocate and manage financial resources to facilitate an effective national innovation system that would then create required knowledge and innovations in all fields of science and technology for the growing economy. As such, an effective NIS is dependent on financial resources allocated by NRF, while NACOSTI liaises with the Kenya National Innovation Agency and the National Research Fund to ensure funding and implementation of prioritized research programmes and ensuring that various agencies involved in ST&I are coordinating and cooperating. Findings from Table 5.3 show that there still exists a gap in funding to NRF as currently the expenditure on R&D stands at 0.8 per cent against a target of 2 per cent as stipulated in the ST&I Act 2013, and 1 per cent based on the STISA target. Moreover, weak linkages between innovators and market and the industry for prototypes remains a challenge.

## **5.2 SWOT Analysis**

To address the third objective, SWOT analysis was carried out. It sought to identify strengths and weaknesses in the institutional structures governing the ST&I sector and understand the opportunities and threats that could be confronted to create an enabling environment for ST&I to steer economic growth. The SWOT analysis conducted is based on assessment of the various legal, policies, and institutions governing the ST&I sector, as provided in Table 5.4.

**Table 5.4: SWOT analysis of ST&I sector**

<b>Strengths</b>	<b>Weaknesses</b>	<b>Opportunities</b>	<b>Threat</b>
<ul style="list-style-type: none"> <li>• Existence of an ST&amp;I Act of 2013 to provide a legal framework for the sector</li> <li>• Established three key institutions (NACOSTI, KeNIA, and NRF)</li> <li>• NACOSTI has collaborated and partnered with several institutions</li> <li>• NACOSTI in consultation with stakeholders developed National Research Priorities informed by the prevailing Government socio-economic policies (Big 4 Agenda)</li> </ul>	<ul style="list-style-type: none"> <li>• Weak harmonization between institutions</li> <li>• Reliance on grants to fund research under NRF</li> <li>• University-Industry-Government collaboration with financial implications are delayed (The National Treasury must approve before a node from the Attorney General for the signing of such Memorandums of Understanding)</li> <li>• Weak Public-Private partnership in ST&amp;I research</li> <li>• NRF not commercialized research outputs</li> <li>• Inadequate funding as NRF is underfunded (e.g., total grants to research programmes since 2016/17 stand at Ksh 4.8 billion)</li> </ul>	<ul style="list-style-type: none"> <li>• Development of guidelines for accrediting research institutions</li> <li>• Develop and implement the National Strategy for STEM education</li> <li>• Develop a framework that attracts industry to collaborate on matters research, science, technology, and innovation</li> <li>• Development of a framework to support the commercialization of research and ideas from individuals, academic institutions, and research organizations</li> <li>• Document and disseminate available R&amp;D infrastructure/equipment in various institutions</li> </ul>	<ul style="list-style-type: none"> <li>• Changing policies in institutions expected to mainstream ST&amp;I in their strategy</li> <li>• Change in government priorities</li> <li>• Inadequate funds and reliance on funding mobilized by NRF</li> <li>• Low appreciation and adoption of locally made products and services</li> </ul>

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## **6. Conclusion and Recommendations**

### **6.1 Conclusion**

This study sought to review the institutional framework supporting ST&I in Kenya. Moreover, the study sought to map out the institutions guiding ST&I in Kenya, their roles, linkages and analyze the constraints and opportunities within the ST&I sector. Using the institutional analysis and Strengths, Weaknesses, Opportunities and Threats approach, policy, legal and institutional framework were analyzed. Regarding legal framework, the findings outlined that Kenya has established the ST&I Act of 2013, which replaced the S&I Act Cap 250 of 1977. This Act established three key institutions that steer the mainstreaming of ST&I in the three sectors of economy (agriculture, industry and services) to achieve the national goal of attaining a 10 per cent annual growth as envisioned in the Kenya Vision 2030.

The ST&I policy framework envisioned to be developed and implemented during the MTP III period (2018-2022) has not yet been developed, although strides have been made to review the draft policy to align it to the regional Science, Technology, and Innovation Strategy for Africa. Furthermore, the country has not yet achieved its regional goal of becoming the most competitive country as it ranked position 10/34 reviewed countries in the 2019 Global competitive report. This is despite establishing three centres of excellence, setting up national research priorities and establishing national science and innovation parks to spearhead in efforts to enable economic transformation in the country. Therefore, it is evident that there remain gaps to be filled in Kenya's policy framework to ensure that ST&I is anchored on a feasible and attainable policy that guides the legal frameworks in the sector.

In addition, the institutions set to spearhead the achievement of the ST&I role in enabling economic growth face weaknesses and threats that derail the achievement of their mandate. As such, the National Research Fund (NRF) has not been allocated the 2 per cent of GDP funding. As of 2018/2019 financial year, research and development funding was allocated 0.49 per cent of the GDP while the 2021/2022 financial year budget allocation does not specify any allocations to NRF. The National Innovation System has been developed, although the interlinkage between various innovation actors is weak as the linkage between academia, innovators, and industry expected to be fostered by the government has not yet been achieved. Therefore, it has been difficult for these institutions to regulate the ST&I sector, manage the innovation system, and fund research and innovation in Kenya.

## **6.2 Policy Recommendations**

1. Given the critical role played by ST&I policy, it is important to fast-track the adoption and implementation of the ST&I policy framework to ensure that the country's ST&I legal framework is anchored on a policy document. Currently, the policy remains a draft.
2. A clear gap that has been established is inadequate funding for research and innovation. There is, therefore, the need for NACOSTI and NRF to consider engaging key institutions owning ST&I policy, such as The National Treasury, Presidential Advisory Unit, Parliamentary Committee on Education, Research and Technology, and the Ministry responsible for, Science and Technology with a view to increasing funding for ST&I as provided for in Section 6(1) of the ST&I Act of 2013. Thus, there is the need to develop capacity among researchers for advocacy and lobbying.
3. Posing as an opportunity to offer interlinkage with the private sector, NACOSTI in collaboration with stakeholders can consider formulating and implementing ST&I-Private Sector Strategy and implementation framework, just as it has done for Ministries, Departments and Agencies (MDAs).
4. NACOSTI could consider developing strategies to ensure more focus on dissemination of research output as compared to production.
5. Given the weak coordination and cooperation, there is the need for coordination and cooperation towards instituting mechanisms to improve Kenya's Global Competitive Index and improve global ranking of Kenya's public and private research institutions based on international ST&I indicators.
6. Identified as a gap, NACOSTI could consider partnering with key players in STEM to develop and implement the National Strategy for STEM education that would ensure long-term access to high quality STEM education, leading to enhanced STEM literacy, innovation and employment.
7. The Kenya National Innovations Agency could consider creating mechanisms that link innovators with prototypes to markets and industries for such.
8. There is no working framework developed for technology transfer and commercialization, thus the need for KeNIA to develop and implement the framework.

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