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NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

PRIORITIES IN SCIENTIFIC, TECHNOLOGICAL AND INNOVATION ACTIVITIES

A. EXECUTIVE SUMMARY

Science, Technology and Innovation are key enablers for moving the world onto a sustainable path. In this regard, the National Commission for Science, Technology and Innovation (NACOSTI) continues to play its pivotal and central role of promoting, regulating, advising and coordinating all matters pertaining to Science, Technology and Innovation (STI) in Kenya in line with the STI Act. In particular, STI Act Section 6(1)(a) specifies that the Commission shall develop, in consultation with stakeholders, the priorities in scientific, technological and innovation activities in Kenya in relation to the economic and social policies of the Government, and the country's international commitments.

Taking cognizance of Global, Regional and National issues, the following are the proposed scientific, technological and innovation priority activities in Kenya in relation to the economic and social policies of the Government, and the country's international commitments. These have been informed by SDGs, STISA 2024, Africa's Development Agenda 2063, Constitution of Kenya 2010, MTP III (2018-2022) under Kenya Vision 2030, STI Act 2013, the Big Four Agenda and draft STI Policy. The proposed priorities in STI cover; R & D and Ethical issues; R&D facilities; STI infusion in county development plans; Investments and Financing STI and Research; Innovation, Technology Transfer and commercialization; Health & Bioeconomic Innovation; Leveraging STI for SDGs and Climate Change Action, Digital/Frontier Technologies to address SDGs and Disasters; Sustainable exploitation of Marine Science and Technology; Scientific data collection and management; STI Institutional Reforms; Multi-agency Framework, and Response Strategies; STEM education and Training; Building Next Generation STI Workforce; STI Communication, Outreach, Advocacy and Diplomacy; Strategic International scientific cooperation and partnerships; Security for Society. This is submitted for consideration by the Committee.



REPUBLIC OF KENYA



NATIONAL COMMISSION FOR
SCIENCE TECHNOLOGY AND INNOVATION
(NACOSTI)

**PRIORITIES IN SCIENTIFIC, TECHNOLOGICAL
AND INNOVATION ACTIVITIES IN KENYA
(2020-2030)**

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PRIORITIES IN SCIENTIFIC, TECHNOLOGICAL AND INNOVATION ACTIVITIES

1.0 Preamble

Scientific discovery, technological breakthroughs, and innovation are the primary engines for expanding the frontiers of human knowledge and are vital for responding to global challenges and opportunities. Scientific innovation promotes sustainable economic growth and job creation, and improves the health of citizens, moves us toward a clean energy future, addresses global climate change, manages competing demands on environmental resources, and ensures national security. Science and engineering research is a valuable source of new knowledge that has driven important developments in fields ranging from telecommunications to medicine, yielding high economic and social rates of return and creating entirely new industries with highly-skilled, high-wage jobs.

Science, Technology and Innovation (STI) is a key component of social integration, sustainable development and poverty eradication. STI is an essential tool for international co-operation, solidarity and globalization. Science, technology and innovation is a key tool for moving the world onto a sustainable path. In the SDGs framework, STI features strongly both in Goal 17, as well as a cross-cutting one to achieve several sectoral Goals and Targets. Fostering innovation is part of Goal 9 related to resilient infrastructure and inclusive, sustainable industrialisation, while Target 9.5 elevates the role of research and innovation policy well beyond STI as one of the Means of Implementation

STI is a key enabler of the Kenya Vision 2030 and is expected to drive the national development agenda by ensuring that all sectors of the economy have access to new technologies and adequate knowledge in order to increase productivity and efficiency. The role of science and technology is further embedded in the Constitution of Kenya (2010), which recognizes the role of science and indigenous technology in development of the nation and commits to promote Intellectual Property Rights (IPR). Further, the Constitution acknowledges academic freedom and freedom of scientific research as a right. By virtue of Article 2 (5), (6) of the Constitution, treaties or conventions ratified by Kenya form part of the law of Kenya. Accordingly, several conventions relating to STI which Kenya has ratified, form part of the legal and Institutional framework of the country.

Kenya's Vision 2030 is founded on intensification in the application of science, technology, and innovation to raise productivity and efficiency levels across the three pillars. Vision 2030 recognizes the critical role played by research and development (R&D) in accelerating economic development in all the newly industrializing countries of the world. Kenya's national research institutes, universities and non-governmental institutions generate knowledge in different areas with varying levels of complexity. Kenya intends to become a knowledge-led economy wherein, the creation,

adaptation and use of knowledge will be among the most critical factors for rapid economic growth. New knowledge will play a central role in the nation's wealth creation and social welfare. Effective exploitation of knowledge is envisaged to provide a regime that will provide a package of incentives for the efficient use of the existing knowledge, creation of new knowledge, and flourishing entrepreneurship. An educated and skilled population will create, share, and use knowledge well in an effective innovation system at the research centres, universities, think tanks, private enterprises and community groups.

Herein presented are the proposed priorities in Scientific, Technological and Innovation activities in Kenya. The proposed priorities cover diverse and extensive aspects in STI. It is envisaged that the STI priorities will be reviewed at least every 5 years or as need arises.

2.0 MTP III

2.1 Overview

The Third Medium Term Plan (MTP III) of the Kenya Vision 2030 outlines the main policies, legal and institutional reforms as well as programmes and projects that the Government plans to implement during the period 2018-2022. It builds on the achievements of the first and second MTPs and prioritizes implementation of the "Big Four" initiatives. The initiatives are: increasing the manufacturing share of GDP from 9.2 per cent to 15 per cent and agro-processing to at least 50 per cent of total agricultural output; providing affordable housing by building 500,000 affordable houses across the country; enhancing Food and Nutrition Security (FNS) through construction of large-scale multi-purpose and smaller dams for irrigation projects, construction of food storage facilities and implementation of high impact nutritional interventions and other FNS initiatives; and, achieving 100 per cent Universal Health Coverage. Additionally, the Plan targets to improve Kenya's ranking in the Ease of Doing Business Indicator from position 80 to at least 45 out of 189. The theme of MTP III is "Transforming Lives: Advancing socio-economic development through the "Big Four"".

The MTP III focuses on nine key foundations and enablers for national transformation namely:

- infrastructure;
- information and communication technology;
- Science Technology and Innovation (STI);
- land reforms;
- public sector reforms;
- labour and employment;
- national values and ethics;
- ending drought emergencies; and
- security, peace building and conflict resolution.

2.2 Role and focus of STI in MTP III

Science, Technology and Innovation (ST&I) sector is a key enabler of the three pillars of the Vision 2030, and is aimed at “Accelerating the Transition into an Innovation-Led and Knowledge Based Economy”. While the previous focus of the Government in the STI Sector was to facilitate the development of a highly skilled human resources base that would sustainably support and trigger innovation in priority areas, the current focus under MTP III for the STI Sector the sector is to drive the transformation agenda by supporting the “Big Four” initiatives and by ensuring that all sectors have access to new technologies in order to increase productivity and efficiency. The STI Sector targets to increase research funding to 2 per cent of the GDP, and for Kenya to attain a Global Competitiveness Index of 85 out of 137 countries by 2022. The STI sector will also seek to capitalize or optimize on emerging issues such as; Rapid technological advancement in the area of digital technologies; Potential for utilization of space technology for national development; Harnessing of natural products for industrial production requiring substantial investment in natural products research; and Synthetic Biology, Stem Cell research and regenerative medicine that is extending therapeutic possibilities for previously incurable diseases.

During MTP III, the sector targets to increase research funding from 0.79 per cent to 2 per cent of the GDP in order to attain position 85 in Global Competitiveness Index ranking out of 137 countries by 2022 from position 91 in 2016. Key programmes earmarked for implementation in the STI Sector include;

- ❖ The Nano-Sciences, Material Science and New Production Technologies Programme, which aims at building state-of-the-art infrastructure for high quality research and technology development.
- ❖ The Space Science Technology Development Programme, which aims at enhancing the teaching, research and development of space science and subsequent use of space technology for peaceful purposes.
- ❖ Energy Technologies Development Programme, that will facilitate the diversification of the country's non-renewable and renewable energy mix to meet the energy demands for industrialization and development, to ensure use of clean energy and increased energy efficiency.
- ❖ Science, Technology, Engineering and Mathematics (STEM) Programme, which will enhance the capacity of education institutions to provide STEM education by facilitating the provision of modern equipment and qualified staff.
- ❖ Coordination of Technology and Innovation Commercialization Programme, which aims at ensuring an effective innovation system to harness the potential offered by modern science and technology for social and economic advancement. National Science, Technology and Innovation (STI) Parks will be established to spur the formation of new ST&I-based businesses and serve as incubation centres for technology and innovations.
- ❖ County Technology and Innovation Delivery Services Programme, which will establish and empower county technology and innovations advisory and prospecting centres to coordinate technology transfer and adoption. The centres will also provide advisory services for the generation and protection of intellectual

assets arising from the interplay between indigenous knowledge/technologies and modern science.

- ❖ Biotechnology, Synthetic Biology and Biosciences Programme, which will build Kenya's capacity to develop and safely apply biotechnology, Synthetic Biology and biosciences in agriculture, health, mining, industry and environmental conservation.
- ❖ Natural Products Programme which will support the development, acquisition, deployment and uptake of appropriate indigenous technologies to ensure optimal use of available natural resources in a sustainable manner. This will spur home-grown innovative culture and develop Kenyan unique products that meet international standards.

MTP III also captures the need for institutional reforms and synergies towards a focused service delivery in line with National Development goals. STI related institutions are given below.

Institutional Reforms

The sector will strengthen the human and institutional capacity for the following STI related institutions

- The National Commission for Science, Technology and Innovation (NACOSTI)
- The Kenya National Innovation Agency (KNIA)
- The National Research Fund (NRF)
- The Kenya Space Agency (KNSA)
- The Kenya National Academy of Sciences (KNAS)
- The Kenya Agricultural and Livestock Research Organization (KALRO)
- The National Biosafety Authority (NBA)
- The Technical Vocational Education and Training Authority (TVETA)
- The Commission for University Education (CUE)
- The Higher Education Loans Board (HELB)
- The Universities Funding Board (UFB)
- The Curriculum Development, Assessment and Certification Council (CDACC);
- The Kenya National Qualification Authority (KNQA)

3.0 Priorities in Scientific, Technological and Innovation Activities in Kenya (2020 – 2030)

STI Priority areas will be guided by MTP III which is focussed on the realization of the Big Four Agenda, viz,

- ❖ Provision of affordable housing by building 500,000 affordable houses across the country;
- ❖ Enhancing Food and Nutrition Security (FNS) through construction of large-scale multi-purpose and smaller dams for irrigation projects, construction of food storage facilities and implementation of high impact nutritional interventions and other FNS initiatives;
- ❖ Achieving 100 per cent Universal Health Coverage.
- ❖ Manufacturing

The STI Priority areas will be in line with the proposed STI Policy which is geared towards harnessing the opportunities within the STI sector and addressing challenges affecting the sector to maximize its contribution to socioeconomic growth and development. The proposed STI policy prioritises the following strategic issues:

- (i) Legal and institutional framework;
- (ii) Human resource development;
- (iii) Education, training and research;
- (iv) Funding STI;
- (v) Technology development, transfer and diffusion;
- (vi) Infrastructure for science technology and innovation;
- (vii) Collaborations and partnerships in Science and Technology
- (viii) Gender mainstreaming in STI; and
- (ix) Performance management framework.

Proposed Priorities in Scientific, Technological and Innovation Activities are presented in Table 1 below.

Table 1: Proposed Priorities in Scientific, Technological and Innovation Activities

	STI PRIORITY AREA	PRIORITY STI ACTIVITIES
1.	R & D and Ethical issues	<p>Review and implement the National Research Priorities Framework</p> <ol style="list-style-type: none"> 1. R&D should be geared towards informed policy-making and management especially in building resilience to disasters by providing hazard information and models, reducing the vulnerability of interdependent critical infrastructure, improving assessments of disaster resilience, and promoting risk-informed behaviour; 2. Develop ethics for dual-use research

		3. Strengthen institutional Bioethics committees
2.	R&D facilities	<ol style="list-style-type: none"> 1. Establish the status of STI infrastructure in public universities, research institutes and national polytechnic 2. Strengthen STI infrastructure in public universities, research institutes and national polytechnic 3. Promote sharing of R&D facilities 4. Promote the establishment of R&D centres of excellence in incubation, manufacturing and science parks 5. Create research universities focusing on R&D
3.	STI infusion in national, and county development plans and programmes for inclusive sustainable development and resilience;	<ol style="list-style-type: none"> 1. Create innovation hubs in the counties 2. Mainstream STI in the county Development plans 3. Evolve STI strategies as part of regional-blocs development strategies 4. Institute mechanisms to integrate micro, small and medium enterprises in the STI landscape for county development. 5. Resilience against pandemics and disasters
4.	Investments and Financing STI and Research;	<ol style="list-style-type: none"> 1. Develop mechanisms for sustainable financial resource mobilization and investment in STI 2. Encourage innovative financing mechanisms by bringing on-board venture and angel capital and other players in the financial sector 3. Introduce R&D levy to appropriate industries 4. Introduce appropriate tax incentives and/or tax relief aimed at encouraging R&D activities
5.	Innovation, Technology Transfer and commercialization for enhanced regional competitiveness, and global innovation index;	<ol style="list-style-type: none"> 1. Establish Science &Technology Parks, Centres of excellence, Innovation hubs, and Incubation hubs and accelerators in the Universities, Research Institutions, and counties 2. Coordinate Technology and Innovation Commercialization Programme 3. Develop entrepreneurship in the Communities to lift them out of poverty

		<ol style="list-style-type: none"> 4. Harness traditional, local and indigenous knowledge to control diseases in human and animals in the communities 5. Create mechanisms of linking innovators with the market and the industries for those with prototypes. 6. Institute mechanisms to improve Kenya's Global Innovation Index (GII) based on relevant indicators. <p>Agencies should promote innovation and commercialization from R&D investments. Efforts should be geared towards support for inducement prizes, fostering the transition of emerging scientific discoveries into engineering disciplines, early-stage technology development, university-industry-government-laboratory partnerships, leveraging of focused and coordinated investments in the Small Business Innovation Research program, and efforts to better link graduate and postdoctoral training with both private and public-sector workforce needs.</p>
6.	Health & Bioeconomic Innovation;	<ol style="list-style-type: none"> 1. Sustainable Financing of Healthcare 2. Central Electronic Health Record 3. Remote Patient Monitoring, Treatment and Intervention 4. Innovation in Research and Innovation Processes and Training Approach 5. Promote personalized (precision) medicine 6. Mental health disorders and challenges 7. public health needs in the midst of pandemics 8. Interest should be focussed on Biomedicine, and Bioeconomy 9. Infectious Disease Modelling, Prediction, and Forecasting: 10. Diagnostic, Vaccine, and Therapeutic R&D: 11. Biomedicine and Biotechnology: <p>Bioeconomy: Bioeconomy represents a convergence of science, infrastructure, innovation and technology, health, and national security that drive economic growth, promote health, and increase public</p>

		benefit across the human, plant, and animal spectrums.
7.	Leveraging STI for SDGs and Climate Change Action	<ol style="list-style-type: none"> 1. Determine the role, strategies and significance of STI in responding to SDGS and Climate Change 2. Evolve innovation driven solutions, to address sustainable development challenges. 3. Adopt best practices for technology cooperation, stressing on building technological as well as financial capacities <ul style="list-style-type: none"> • 4. Restructure intellectual property regimes 5. Foster STI partnerships in the larger global context. 6. Enhance International Cooperation for access to clean energy research and technology 7. Promote the development of clean and smart cities and territories
8.	Digital/Frontier Technologies to address SDGs and Disasters;	<p>Seize Digital Technologies /frontier technologies in capacity building on health, agriculture and environmental issues at community level</p> <ul style="list-style-type: none"> • Priority should be given to investments that address the challenges of, and tap the opportunities afforded by, the Big Data revolution, artificial intelligence (AI), Blockchain, Robotics, Internet of Things, Cloud computing, Synthetic Biology, Nano, 3-D printing, Digital. Likewise, investments in advanced communications, networking, and broadband access will ensure that citizens can continue to work and access education and medical services remotely.
9.	Sustainable exploitation of Aquatic/Marine Science and Technology.	<p>Taking cognizance that the ocean is the single largest natural asset on the planet which represents some 99% of the earth's living volume, and that It supplies 15 percent of humanity's protein needs among other needs, it is prudent to;</p> <ol style="list-style-type: none"> 1. Build capacity in Aquatic/Marine science and technology 2. Leverage on STI in the sustainable exploitation of Aquatic/marine resources

		<ol style="list-style-type: none"> 3. Enhance governance and sustainable management of aquatic/marine ecosystem. 4. develop integrated approaches to Blue Economy planning and strategic management with a focus on protection, restoration, and sustainable exploitation of aquatic resources, as well as establishment of aquatic centres of excellence 5. Promote Blue Economy strategies at National, Regional and International Level. 6. Finance and position blue economy for inclusive sustainable development
10.	Scientific data collection and management	Coordinate the establishment of the Kenyan node of African science Technology and Innovation observatory for collection of data, analysis and reporting of ST&I Indicators
11.	STI Institutional Reforms;	<p>Review STI Act, relevant regulations, policies, indicators and frameworks to include or update;</p> <ol style="list-style-type: none"> 1. formation of STI Council 2. mechanisms for promoting, monitoring and evaluation of STI programmes 3. National Research Priorities Framework 4. Establish and operationalize a multi-sectoral taskforce to map the national innovation system 5. Establish a working group to develop a National STI strategy 6. Establish the Advisory research committees 7. Develop a National Critical skills Development strategy 8. Review National Biotechnology Policy 9. Develop National Intellectual Property Policy 10. Facilitate Multisector Partnerships and Technology Transfer between and among R&D departments and agencies, academic institutions 11. Lobby for inclusion of STI activities in Performance Contracting framework so that MDAs can be reporting on STI activities, just like is the case for National Cohesion and Values, NACC and NCPWD.

12.	Multi-agency Framework, and Response Strategies;	Develop mechanisms for multi-agency response strategies
13.	STEAM (Science, Technology, Arts, & Mathematics) Education, Training and Diffusion.	<p>Coordinate cross-sector collaborative efforts that will provide students with access to high-quality STEAM education and advanced workforce pathways.</p> <ol style="list-style-type: none"> 1. Science, technology, engineering, and mathematics (STEM) education should include improving STEM instruction and learning, increasing and sustaining youth and public engagement in STEM, enhancing the STEM experience of undergraduate students, providing STEM learning opportunities to groups historically underrepresented in STEM fields, designing graduate education for tomorrow's STEM workforce, and enhancing the STEM experience and value proposition through digital tutors, learning analytics, simulations, games, and embedded assessment. 2. There is need to develop and implement the National Strategy for STEAM Education that will ensure that all citizens have lifelong access to high quality STEAM education leading to enhanced STEAM literacy, innovation, and employment. 3. The is need for STEAM education and training to incorporate the 21st-century soft skills of communication, collaboration, critical thinking, and creativity so as to create a tech society that is able to diffuse what is learned into society.
14.	Building Next Generation STI Workforce	Harmonized investments in R&D and STI workforce advance a Nation's economic prosperity and national security. The foundation of these investments is the STEM ecosystem-a cross-sector collaborative effort that provides all Kenyans with access to high-quality STEM education and advanced workforce pathways throughout their lifetimes. Relevant departments and agencies have prioritized investments in research programs and other related activities that advance innovation in

		<p>STEM education and increase diversity, equity, and inclusion in STEM.</p> <p>Prioritize education investments that: (1) support learning through the development of infrastructure and tools for delivery of both remote and in-person learning; (2) develop mechanisms to attract, prepare and support all Kenyans to pursue STEM pathways, especially for underrepresented and underserved populations; (3) create effective experiential and work-based learning opportunities to engage students in STEM; (4) develop the next generation of teachers and faculty prepared to advance STEM education; (5) expand broadband access and improve teaching and learning modalities for remote learners; and (6) ensure a robust pipeline of Kenyan students capable of pursuing graduate degrees in STEM. Research advances and best practices in STEM teaching and learning should be disseminated throughout the STEM ecosystem to ensure high levels of STEM literacy for all Kenyans.</p>
15.	STI Communication, Socialization, Outreach, Advocacy and Diplomacy for enhanced trust in STI;	<ol style="list-style-type: none"> 1. Disseminate research advances and best practices in STEM/STEAM teaching and learning throughout the STEM/STEAM ecosystem to ensure high levels of STEM/STEAM literacy 2. Sensitize stakeholders on draft STI policy, indicators 3. Promote gender mainstreaming in STI 4. Develop mechanisms for integrating and embedding science, technology, innovation and research into society 5. Institute measures that encourage the co-evolution of STI and society in close and continuous interaction, taking cognizance that they are mutually reinforcing. This requires the creation of an environment where STI speaks and listens to different stakeholders, answers the needs of society, and becomes the endowment of human communities.

16.	<p>Strategic International and National scientific linkages, cooperation and partnerships.</p>	<ol style="list-style-type: none"> 1. Identify the international obligations where the STI Sector agencies are the Lead agency and activities within which supports social and economic policies 2. Reviewing draft Biosecurity policy and biosecurity Bill 3. Hold stakeholders meeting on draft Biosecurity policy and bill 4. Submit draft Biosecurity Policy and Bill to cabinet 5. Create an ICGEB Regional Research Centre of excellence 6. Coordinate project counterparts in AFRA Thematic area projects 7. Hold stakeholders meeting on the output of AFRA thematic areas projects 8. Maintenance of detectors at Karura (infra-sound) and Mt Kilimanjaro (Seismic station) 9. Enhance collaborations and Partnerships in STI 10. Set up a system of cooperation between researchers in academic and research institutions, with industry and other end-users 11. Enable the sharing of research findings between researchers, industry and other end-users based on mutually acceptable agreement without infringing on intellectual property rights aimed at improving products and services
17.	<p>STI in Public safety, and National Security</p> 	<p>Taking note that technological advancements and breakthroughs have a potentially dramatic impact on order and security, there is need to:</p> <ol style="list-style-type: none"> 1. Deploy STI to enhance protection from new threats to security such use of Biological or chemical weapons, 2. Deploy STI to boost rapid and resilient response to natural and man-made disasters 3. Develop STI strategies for Public Safety and National Security <p>Public security is the function of governments which ensures the protection of citizens, persons in their territory, organizations, and institutions against threats to their well-being – and to the prosperity of their communities (wiki).</p>

		<p>Public safety involves protecting the public — safeguarding people from crimes, disaster, and other potential dangers and threats.</p> <p>“Security” often has to do with a group's efforts to protect its members from harm. “Safety” most often relates to a personal feeling of being free from harm or danger. Security seems to define efforts and measures that are outside of an individual, while safety is closer to an inner feeling.</p>
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