National Commission for Science, Technology and Innovation

African Centre for Technology Studies
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STI ROADMAP

HARNESSING **SCIENCE TECHNOLOGY** AND **INNOVATION** FOR REALIZATION OF **SUSTAINABLE DEVELOPMENT** GOALS IN **KENYA**

Prepared By: **ACTS AND NACOSTI**

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ABBREVIATIONS

ABSA	Amalgamated Banks of South Africa Limited
ABDP	Aquaculture Business Development Program
ACA	Anti-Counterfeit Agency
ACTS	African Centre for Technology Studies
ADPs	Annual Development Plans
BPO	Business Process Outsourcing
CIPPs	County Integrated Development Plans
CIMES	County Integrated Monitoring and Evaluation Systems
COMESA	Common Market for Eastern and Southern Africa
CGIAR	Formerly \Consultative Group for International Agricultural Researchers
CGS	Credit Guarantee Scheme
CSA	Climate Smart Agriculture
CSOs	Civil Society Organizations
CTA	Cotton Textile and Apparel
CO2	Carbon Dioxide
DANIDA	Danish International Development Agency
DTB	Diamond Trust Bank
EDE	Ending Drought Emergencies
EPZs	Export Processing Zones
EPZA	Export Processing Zones Authority
EIPs	Eco-Industrial Parks
ECOWAS	Economic Community of West African States
FAO	United Nations Food and Agriculture Organization
FCDO	Foreign, Commonwealth and Development Office
GERD	Gross Domestic Expenditure on Research and Development
GESIP	Green Economy, Strategy and Implementation Plan
GDP	Gross Domestic Product
GoK	Government of Kenya
GDP	Gross Domestic Product
2G/3G/4G	Second, Third and Fourth Generation respectively
IAIP	Integrated Agro-Industrial Park
IAT	Inclusive Agricultural Transformation
IATT	UN Inter-Agency Task Team
IATWC	Inter-Agency Technical Working Committee
ICIPE	International Centre of Insect Physiology and Ecology
ICT	Information Communication and Technology

IDRC	International Development Research Centre
IGAD	Intergovernmental Authority on Development
IFAD	International Fund for Agricultural Development
ILRI	International Livestock Research Institute
IP	Intellectual Property
IPs	Industrial Parks
ITK	Indigenous Technical Knowledge
KAM	Kenya Association of Manufacturers
KAMIS	Kenya Agricultural Market Information System
KALRO	Kenya Agricultural and Livestock Research
KBS	Kenya Bureau of Standards
KECOBO	Kenya Copyright Board
KEPSA	Kenya Private Sector Alliance
KeLCoP	Kenya Livestock Communication Project
KENIA	Kenya National Innovation Agency
KenGen	Kenya Electricity Generating Company
KEPHIS	Kenya Plant Health Inspectorate Services
KCB	Kenya Commercial Bank
KCSAP	Kenya Climate Smart Agriculture Project
KMFSED	Kenya Marine Fisheries and Socioeconomic Development
KM	Kilometers
KNBS	Kenya National Bureau of Statistics
KIRDI	Kenya Industrial Research and Development Institute
KIPI	Kenya Intellectual Property Institute
Ksh	Kenya Shillings
LIWA	Linking Industry with Academic
MDAs	Ministries Departments and Agencies
MDGs	Millenium Development Goals
MITAs	Material/ Information Transfer Agreement
MSEs	Micro and Small Enterprises
MSEA	Micro and Small Enterprises Authority
MSMEs	Micro, Small and Medium Enterprises
MTPs	Medium Term Plans
MoE	Ministry of Education
MoALFC	Ministry of Agriculture, Livestock, Fisheries and Cooperatives
MoITED	Ministry of Industrialization, Trade and Enterprise Development
MVA	Manufacturing Value Added
NACOSTI	National Commission for Science Technology and Innovation
NEMA	National Environmental Management Authority
NCBA	National Commercial Bank of Africa
NEPAD	New Partnership for Africa's Development
NIMES	National Integrated Monitoring and Evaluation System

NRF	National Research Fund
NVSP	National Value Chain Support Program
PCT	Patent Cooperation Treaty
RAI	Rural Access Index
REAL	Rivatex East Africa Limited
R&D	Research and Development
SDGs	Sustainable Development Goals
SDP	State Department for Planning
SEZs	Special Economic Zones
STI	Science Technology and Innovation
SSA	Sub-Saharan Africa
TFM	Technology Facilitation Mechanism
TV	Television
TVET	Technical and Vocational Education and Training
USD	United States Dollar
UN	United Nations
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
VNR	Voluntary National Review
VLRs	Local Voluntary Reports
WB	World Bank
WIPO	World Intellectual Property Organization
WFP	World Food Program

1. CHAPTER ONE: INTRODUCTION

1.1 Background

The United Nations (UN) 2030 Agenda for Sustainable Development that was unanimously adopted by all UN Member States, reaffirmed the role of Science, Technology and Innovation (STI) as a key tool in the implementation of the Sustainable Development Goals. Pursuant to Paragraph 70 of the 2030 Agenda for Sustainable Development Goals, the Technology Facilitation Mechanism (TFM) was launched to facilitate multi-stakeholder collaboration and partnerships through the sharing of information, experiences, best practices and policy advice among member states, civil society, the private sector, the scientific community, United Nations entities and other stakeholders.

A Global Programme to support Member States in the development of their STI for the SDGs Roadmap was established by the United Nations Inter-Agency Task Team (IATT). The IATT further developed a draft guide-book on development of national STI for SDGs Roadmap to guide member states who expressed interest in STI for SDGs Road maps Program. The objectives of the Program are:

- **To build capacity for and scale up adoption of the Member States' STI for SDGs Roadmaps.**
- **To promote good practices, knowledge sharing, peer learning, international cooperation and partnerships on the design and implementation of such roadmaps.**
- **To maximize opportunities and mitigate the risks of STI and the frontier technologies to accelerate achievement of the SDGs; and,**
- **To institute mechanisms to continuously scan the horizons, analyze the gaps, track progress and inform corrective measures.**

Based on the submission of Expression of Interest (EoI) in January 2019 and a Concept Note in February 2019, Kenya was selected to participate in the pilot phase/programme. The development of the Kenyan STI for the SDGs Roadmap is led by the State Department for Planning, (under the National Treasury), which is responsible for all matters related to the SDGs and the National Commission for Science, Technology and Innovation (NACOSTI), which is the Kenyan government's

main agency responsible for advisory and policy matters of STI. The African Centre for Technology Studies (ACTS) was retained to provide technical advisory support to the two Agencies.

1.2 Objectives of the STI for SDGs Roadmaps

The Kenyan technical team has developed a roadmap for mainstreaming STI in the implementation of SDGs as per the guidelines prepared by IATT. The main objective of this roadmap is to leverage STI for realization of SDGs in Kenya. The following are the specific objectives:

a. To assess the status of SDGs implementation progress in Kenya

b. To identify the SDGs for STI driven interventions and actions

c. To determine the STI strategies for realization of the SDG targets; and,

d. To develop an implementation plan for the roadmap for the selected SDGs.

1.3 Technical Team

The technical team that continued the STI for SDGs process consisted of the following:

TEAM LEADER	**Prof. Tom Ogada**		
NACOSTI	**1.** Dr David Njubi **2.** Ms. Margaret Muthee **3.** Dr David Ngigi	**State Department for Industrialization**	**4.** Mr Nobby Macharia
ACTS	**5.** Dr Ann King'iri **6.** Dr Agnes Lutomiah **7.** Ms. Nora Ndege **8.** Dr Joshua Owade	**KIRDI**	**9.** Dr Kelvin Khisa
KALRO	**10.** Dr Lusike Wasilwa **11.** Dr Festus Murithi **12.** Dr Wellington Mulinge	**State Department for Planning**	**13.** Mr Domnick Loriakwe **14.** Mr Nakadio Etaan Cosmas **15.** Dr John Nyangena **16.** Mr George Bosire **17.** Mr Samuel Kirui

The technical team that started the STI for SDGs process in 2019 comprised of the following:

TEAM LEADER	Prof. Tom Ogada
NACOSTI	**1.** Dr Roy Mugiira member **2.** Mr Boniface Wanyama **3.** Dr David Njubi
State Department for Planning	**4.** Mr. Joshua Opiyo **5.** Mr Stephen Odhiambo **6.** Mrs Sarah Muui
ACTS	**7.** Ms. Nora Ndege **8.** Mrs Caroline Bwire **9.** Mr Joshua Ombaka
Ministry of Education	**10.** Mr Philip Kinara

1.4 Methodology

Preparation of the Roadmap commenced in 2019 through a consultative process bringing together representatives of government ministries, departments and agencies (MDA's) of the key sectors as well as non-state actors such as think tank institutions relevant to the realization of the SDGs in Kenya.

The technical team held working sessions between January and August 2019 to review the IATT guidelines and identify the key sectors that would be considered through STI-driven interventions to accelerate the realization of SDGs. A draft Roadmap was developed focusing on Agriculture and Manufacturing Sectors due to their high contribution to the country's economy. The planned validation and pilot test of the document were halted due to the COVID-19 Pandemic knock on effects and disruptions during the 2020 fiscal period and also due to lack of resources arising from the budget austerity cuts by the government to support the mechanisms that were put in place to address the effects of the Pandemic on the economy and people's livelihoods.

From January 2022, the process was revived following the easing of the Covid-19 Pandemic protocols and restrictions and upon securing of resources by NACOSTI, through ACTS, from the Canadian International Development Research Centre (IDRC). The technical team re-convened and has since held a series of meetings, both online and virtual, including the two five-days workshops, which were organized to update and validate the draft STI for SDGs Roadmap. The team used the updated (2020 version), the SDGs National Indicator Framework that provides data on the progress of the various SDGs indicators to review the status of SDGs achievement in the country. Further, the 17 SDGs were subjected to the assessment criteria developed by the Technical

Team, to prioritize and identify those to be considered for STI intervention.

The assessment criteria comprised of 5 parameters[1] namely: SDGs that are not doing well or stagnating, the national development priorities, the multiplier effects and the in linkages of SDGs, the capacity to monitor the progress of the SDGs indicators, and the budgetary allocation on the SDGs (capacity to attract funding for SDGs implementation). The two SDGs that had earlier been identified, 2 and 9 were re-affirmed based on the assessment criteria, thus confirming their central position in enabling the country to achieve most of the SDGs using STI-driven interventions. This set the foundation for the review and development of other sections of the roadmap, prioritization of STI interventions and the tested alternative pathways to formulate the STI Roadmap to guide realization of the two (2) SDGs.

1.5 Structure of the STI for SDGs Roadmap

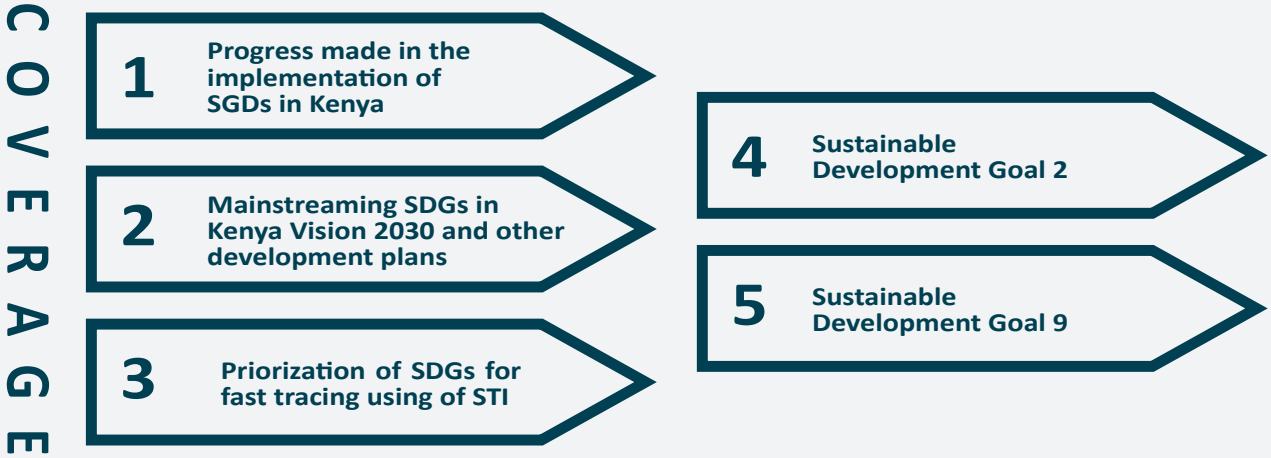
The document is comprised of four chapters. Chapter One captures the introduction with a short background on the role of STI as a key tool in the implementation SDGs and the establishment of TFM to facilitate multi-stakeholder collaboration and partnerships through the sharing of information, experiences, best practices and policy advice among Member States, civil society, the private sector, the scientific community, United Nations entities and other stakeholders.

In Chapter Two, a situational analysis outlines Kenya's progress in the implementation of the SDGs. The chapter includes priorities for SDGs, gaps and targets and the STI entry points for effective integration of SDGs in the national development agenda. In addition,the Chapter has identified the gaps in the STI sector and strategies to enhance the attainment of the identified SDGs targets, mapping the potential STI entry points to address the identified gaps.

Chapter Three outlines the vision, mission and strategic objectives to guide implementation of the roadmap. The Chapter also identifies intervention strategies or pathways that will be utilized in the achievement of strategic objectives. In chapter Four of the implementation plan for the roadmap, mapping of the proposed pathways to support realization of strategic objectives is presented.

1 An initial list of 9 parameters had been developed by the Technical Team: SDGs that are not doing well/stagnating; the multiplier effect of the SDG; SDGs that consider the national development priorities; leaving no one behind; capacity to monitor the progress of the SDGs' indicators; data adequacy, credibility and capacity; capacity to apply innovation; capacity to support the diverse development pathways/strategy; and budgetary allocation on the SDGs (capacity to attract funding).

2. CHAPTER 2: SITUATIONAL ANALYSIS



2.1 Progress made in Implementation of SDGs in Kenya

The government undertook several activities outlined in the sub-sections below, to ensure a smooth transition from the Millennium Development Goals to Sustainable Development Goals.

2.1.1 Transition from MDG to SDGs

In September 2000, world leaders signed the Millennium Declaration, in which they committed to achieve a set of eight measurable

goals referred to as Millennium Development Goals (MDGs). These goals were to be achieved by 2015 and aimed at eradicating extreme poverty and hunger, achieve universal primary education, promote gender equality and empower women, reduce child mortality, improve maternal health, combat HIV/AIDs, malaria, and other diseases, ensure environmental sustainability and develop a global partnership for development. These goals helped to steer development cooperation, increased mutual accountability and mobilized support from all development actors and practitioners.

However, in recognition of the mixed success of the MDGs implementation and the fact that a new development agenda was needed beyond 2015, countries agreed in 2012 at Rio+20, the UN Conference on Sustainable Development, to establish an Open Working Group to develop a set of Sustainable Development Goals (SDGs). The SDGs were adopted by all United Nations Member States as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030.

The objective of the new development framework was to produce a set of universal goals that meet the urgent environmental, social and economic challenges facing the world. Kenya adopted a rights-based approach to addressing the SDGs and launched the SDGs Roadmap (2016-2018) as a transition strategy to anchor achievement of the SDGs in the national development planning and further to carry forward the unfinished business of MDGs. The following activities were conducted as part of transition from MDGs to SDGs:

a. The MDGs End Term Report was prepared in 2016, which highlights achievements made during the period 2000 to 2015 and the unfinished business. This report provided lessons learnt and the baseline information for the implementation of the SDGs.

b. In 2016, the Government launched the SDGs Roadmap to guide the transition from MDGs to SDGs.

c. A Cabinet Memo was issued in October 2016 directing all Government Ministries, Departments and Agencies to mainstream SDGs in the policy, planning, budgeting and programming, and prepare bi-annual status reports on SDGs. It also mandated the Cabinet Secretary for Devolution and Planning to liaise with the County Governments to mainstream SDGs within the county policy, planning, budgeting and programming. Since then, siginificant efforts have been made to build capacity and mainstream SDGs at national and county levels.

d. An Inter-Agency Technical Working Committee (IATWC) on SDGs was set up, drawing membership from the Government Ministries, Departments and Agencies, the Council of Governors, Academia, UNDP, Civil Society, Parliamentary Caucus on SDGs and Business, and the Private Sector to support coordination of implementation and reporting of progress of SDGs in Kenya;

e. The Kenya National Bureau of Statistics (KNBS) identified 136 out of the 232 indicators the country is capable of monitoring with available data. Data on the Indicators is updated using the SDGs National Indicator Framework.

2.1.2 Assessment of Government's Readiness to Implement Sustainable Development Goals

To enhance the implementation of the SDGs in Kenya, the Government in collaboration with the United Nations Agencies in Kenya through the UNDP Kenya Office, commissioned SDGs Policy Gaps Analysis Study in 2018, to assess the country's policy preparedness to implement the 2030 Agenda for Sustainable Development. The analysis found that the Kenya Vision 2030 and its MTPs (III) addresses, directly or indirectly, most of the targets of the 2030 Global Agenda for Sustainable Development at 97 percent (132 out of the 138) of the relevant SDGs targets. In addition, a detailed analysis was done on the extent to which existing sectoral policies and strategies contribute to achievement of the SDG targets. Overall, the study revealed that sectoral policies and strategies contribute partially or fully to 67 percent (92 of the 138) of the relevant SDGs targets.

2.1.3 Setting up Institutional Framework and Coordination Mechanisms

According to the Executive Order No. 1 of 14th January 2018 (revised in May, 2020) on the Organization of the Government of the Republic of Kenya, one of the functions of the State Department for Planning (SDP) is responsible for coordination of Implementation, Monitoring and Evaluation of Sustainable Development Goals (SDGs). Coordination is done through the SDGs Coordination Directorate which is one of the six technical directorates within the SDP while the implementation is done by the respective line ministries in collaboration with other stakeholders. At the sub-national level, coordination is done through the SDGs Liaison Office established within the Secretariat of the Council of Governors.

The country has made significant efforts to involve other stakeholders in SDGs implementation and monitoring. The Kenya Private Sector Alliance (KEPSA) and SDGs Kenya Forum with a membership of diverse Private Sector and Civil Society Organizations (CSOs) constituencies seeking to contribute to the implementation of the 2030 Agenda are also in place and co-chair the IATWC with the Cabinet Secretary for National Treasury for Planning.

2.1.4 Mainstreaming SDGs in Kenya Vision 2030 and Suusessive MTPs

Kenya Vision 2030 aims to transform Kenya into "a newly industrializing, globally competitive and middle-income country providing a high quality of life to all its citizens by 2030 in a clean and secure environment". The Vision has three pillars: Economic, Social and Political. The three pillars are anchored on the foundations and enablers for national transformation, which include: infrastructure; information and communications technology (ICT); science, technology and innovation (STI); land reforms; public sector reforms; labour and employment; national values and ethics; ending drought emergencies (EDE); security; peace building and conflict resolution.

The 2030 Agenda for Sustainable Development and the SDGs have been mainstreamed in the Kenya Vision 2030 through suvccesive Medium-Term Plans, County Integrated Development Plans (CIDPs), Sectoral Plans and the Budgeting Process (Medium Term Expenditure Framework; MTEF).

2.1.5 Creating Ownership of Sustainable Development Goals

Since adoption of SDGs in Kenya in 2016, the Government has continued to enhance awareness and build capacity among all stakeholders. The 2017 and 2020 Voluntary National Reviews identified low levels of awareness on the SDGs as one of the challenges that might hinder their implementation. Subsequently, the country embarked on enhanced campaigns on advocacy and awareness creation through focus group discussions, sensitization fora, workshops, discussion panels, and social media communication platforms. The Government of Kenya recognizes that stakeholders' engagement and participation are integral elements in developing, designing and implementing policies and development strategies that benefit all Kenyans.

The Government interacts with a broad range of stakeholders, from those who have interest in facilitating the implementation of the SDGs Agenda to those that are beneficiaries of the realization of the SDGs and their targets. The key stakeholders are the National Government, the Council of Governors and County Governments, Parliament, Civil Society Organizations, Private Sector, UN Agencies in Kenya, Academia and Research Institutions, Volunteers and the society at large.

2.1.6 Tracking and Reporting on SDGs implementation Progress:

The government through the Inter Agency Technical Working Committee (IATWC) prepared the 2019 SDGs Status report, and undertook Voluntary National Reviews (VNR) on SDGs in 2017 and

2020. In addition, the popular version of the 2020 VNR formed the basis for development of the Local Voluntary Reports (LVRs) for Kwale, Kisumu, Busia, Marsabit and Taita Taveta counties.

2.2 Prioritization of SDGs for fast tracking using STI

2.2.1 Status of SDGs in 2021

According to the UN Sustainable Development Report of 2021, Kenya had an overall performance score of 60.2, higher than the 51.9 which was the average score for Sub Saharan Africa (SSA) countries. However, the Country was ranked in the lower half globally, 118 out of 165. In SSA, the Country is ranked behind Cape Verde (68.1), Mauritius (66.7), South Africa (63.7), Gabon (62.8), Ghana (62.5), Botswana (61.9) and Namibia (61.8). Table 2.1: below shows a summary of Kenyan SDGs performance trend. There were no data for SDG 10 and 12.

Table 2.1: Kenya's SDGs Performance Trends in 2021

Status		SDG
1	On Track	**SDG 13:** Climate Action
2	Moderate Improvement	**SDG 1:** No Poverty **SDG 3:** Good Health and Well-being **SDG 5:** Gender Equality **SDG 7:** Affordable and Clean Energy **SDG 8:** Decent Work and Economic Growth) **SDG 9:** Industry, Innovation and Infrastructure
3	Stagnating	**SDG 2:** Zero Hunger **SDG 4:** Quality Education and lifelong learning **SDG 6:** Clean Water and Sanitation **SDG 11:** Sustainable Cities and Communities **SDG 16:** Peace, Justice and Strong Institutions **SDG 17:** Partnerships for the Goals
4	Facing major challenge (s) and decreasing	**SDG 14:** Life below water **SDG 15:** Life on Land

2.2.2 Selection of Prioritization Criteria

In order to identify the SDGs for ST&I intervention, all the 17 SDGs were subjected to an assessment criteria. The technical committee through a consultative process, generated a long list of 9 assessment criteria. These criteria were weighted through scoring by each of the 20 members of the technical team and the top five were shortlisted. These are shown in Table 2.2:

Table 2.2: Long and Shor Lists of Evaluation Criteria

Long List	Short List
-	-
1. SDGs that are not doing well/Stagnating	1. Those SDGs that are not doing well/Stagnation
2. The multiplier effects of the SDGs	2. Consider the National Development Priority(s)
3. SDGs that consider the National Development Priorities	3. The multiplier effect of the SDG
4. Leaving no one behind	4. Capacity to monitor the progress of the SDG's Indicators
5. Capacity to monitor the progress of the SDGCs' Indicators	5. Budgetary allocation on the SDGs (Capacity to attract funding)
6. Data Adequacy, Credibility and Capacity	
7. Capacity to apply Innovation	
8. Capacity to support the diverse development pathways strategy	
9. Budgetary allocation on the SDGs	

2.2.3 Preparation of the Shortlist of SDGs using the selected Prioritization Criteria

The 17 SDGs were assessed against the above 5 parameters. Each member of the technical team was asked to independently score the SDGs against these criteria on a Likert scale of 1-5, with 1 being the least prioritized and 5 the highest. The scores were summed and ranked. Box 2.1: shows the top prioritized SDGs:

Box 2.1: Top five prioritized SDGs for deployment of STI

All the five prioritized SDGs will be pursued, in phases. For phase 1. SDG 2 and SDG 9 were selected for further situational analysis due to the close linkages between agriculture and manufacturing sectors in Kenya mainly through agro-processing and value addition.

Agricultural Sector

The agricultural sector remains the most important sector for alleviation of poverty; stimulation of economic growth and development; and achievement of SDGs Goals 1 and 2. The agricultural sector's importance in poverty reduction is as a result of the fact that about 60% of the population earn their livelihood from the sector. Agriculture contributes over 50% of the Gross Domestic Product (GDP), about 65% of the export earnings and 18% of the formal employment (Economic Survey, 2015). Agriculture also, provides raw materials for the manufacturing sector. Out of the over 50% contribution to the GDP by the agricultural sector, direct contribution is more than a third of the national GDP (World Bank Group, 2019a), while an additional 25% is contributed through linkages with other sectors such as the manufacturing sector (World Bank Group, 2019b) etc.

The government has a policy to address food and nutrition insecurity including the hidden hunger micronutrient deficiencies, increase productivity, reduce post-harvest losses and promote agro-processing (MoE, 2019a). In order to achieve 100% food and nutritional security in the country, there is focus to improve agricultural productivity and value-addition practices through agro-processing. With the need to promote industrialization, the agricultural sector seeks to promote agro-processing as a way of enhancing the returns and contribution of the sector to the GDP. It has been shown that agro-processing sub-sector contributes about 3.2% of the GDP and 2.4% of the national employment in the country (Government of Kenya, 2019).

Some of key agro-processing sectors in Kenya include meat and meat products, fish, fruits and vegetables, fats and oils, sugar, tea and coffee, grains and dairy products (KAM, 2018). The agricultural sector holds the potential of transforming the economy of the country as it contributes 75% of the total industrial raw material (WFP, 2018). Therefore, increasing productivity of the agricultural sector has an input in the expansion of the manufacturing sector.

Manufacturing Sector

The manufacturing sector is crucial for the achievement of the Kenya Vision 2030 and is arguably the most important for job creation because of its strong forward and backward linkages with other sectors of the economy. The sector mainly produces agro-processing products such as: textiles, leather, construction materials and machinery. It is largely dominated by Micro and Small Enterprises (MSE) that are characterized by low skilled jobs.The contribution of the manufacturing sector to GDP has been on decline in recent years from 10.2% in 2014 to 9.2% in 2016 (Ministry of Devolution and Planning, 2017). Considering that the country seeks to explore opportunities and improve the GDP contribution of this sector, active efforts are in place to improve its performance.

The Big Four Agenda identified agro-processing as one of the eight priority areas of expansion in the manufacturing sector (Kenya Association of Manufacturers, 2018). The value-addition practices and agro-processing activities in the agricultural sector have been so limited, with the country getting less revenue from the export of raw material. Although the MTP III had projected 15% contribution to the GDP by 2022, the share of the manufacturing sector was 7.2% in 2021

(KNBS, 2022). The government has set to expand the contribution of the agro processing sub-sector to at-least 50% of the manufacturing sector contribution to GDP.

Opportunities in agro-processing include commercial irrigation, grains milling and marketing (maize, rice and wheat), sugar, dairy, fruits (mangoes, pineapples and oranges), poultry, pigs and oil crops (sunflower, sesame, canola and groundnuts). Opportunities in light manufacturing related to agriculture include construction materials, agricultural machinery and equipment, plastic and packaging industry, leather industry, pharmaceuticals and animal feeds.

The development of the agricultural sector plays an important role in ensuring food security (SDG 2) for the country as it ensures availability of food through adequate production and supply of crops, livestock and fish and fisheries products. Agriculture is the second largest contributor to Kenya's Gross Domestic Product (GDP) after the service sector and fundamentally drives the country's economy. On the other hand, Sustainable Development Goal 9 (SDG 9) aims to build resilient infrastructure, promote sustainable industrialization and foster innovation. In addition, it is closely linked to other SDGs related to job creation, sustainable livelihoods, improved health, technology and skills development, gender equality, food security, green technologies and climate change. The two sectors can contribute to the main objective of the Big Four Agenda, namely, inclusive sustainable economic growth, foster job creation and reduction of poverty.

2.3 Sustainable Development Goals 2: Gaps, Targets and Programmes

Table 2 Summary of the status of various objectives under SDG 2.

Objectives	Indicators	Performance			
		2014	2016	2018	2019
2.1. Food and nutrition security	Prevalence of undernourishment		30	30	25
	Prevalence of moderate food insecurity		47.4		68.5
	Prevalence of severe food insecurity		19.1		25.7
2.2. Stunting and Malnutrition	Prevalence of stunting	26.0	29.9		
	Prevalence of malnutrition (wasting)	4.0	6.7		
	Prevalence of obesity	4.1	4.9		

Objectives	Indicators	Performance			
		2014	2016	2018	2019
2.3.Increase productivity and income of farmers	Volume of production per labour unit				
	Average income of small-scale food producer				
2.4. Sustainable agricultural production	Proportion of agricultural area under productive and sustainable agriculture				
2.5. Genetic diversity					
2a	Agricultural orientation index for government expenditure				
	Total official flow of financial resources to agriculture	0.05	0.06	0.05	0.05
2b	Producer support estimate and agricultural export subsidies				
2c	Food price anomalies	8.7		1.37	6.43

2.3.1 SDG 2.1 (Food and Nutrition Security)

The objective of SDG 2.1 is to end hunger and ensure access by all people, (in particular the poor and people in vulnerable situations, including infants) to safe, nutritious and sufficient food all year round by 2030. The Sustainable Development Report 2022, shows that whereas there wa a slight decline in undernourishment from 30% in 2016 to 25% in 2019, the indicators on food insecurity are worsening. Whereas IFPRI 2019 ranks the country 87th and 7th in the World and SSA, respectively and that the food security index for Kenya was above the average for the SSA region, the likelihood of realising the objective of SDG 2.1 is doubtful unless significant efforts are made.

The Big Four Initiative under Food and Nutrition Security pillar seeks to ensure 100% food and nutrition security among all Kenyans by 2022. Achieving 100 % food and nutrition security by 2022 is ambitious for Kenya considering that the proportion of the population that live below the poverty line is 36.2 %. The National Agricultural Investment Plan (2019-2029) targets to reduce the number of food insecure people from an average of 2.7 million people to less than 1.3 million by 2029[2].

2 National Agricultural Investment Plan.

2.3.2 SDG 2.2 (Stunting and Malnutrition)

The objective of SDG 2.2 is to end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons. In 2016, the prevalence of stunting was 29.9 % up from 26.0 % in 2014, the prevalence of malnutrition was 6.7 % up from 4.0 % in 2014 whereas the prevalence of obesity was 4.9 % up from 4.1 %. In all the three indicators, the scores show a worsening trend. Kenya is a signatory to the Malabo Declaration that was signed by all African Heads of State in Malabo in 2014. As per the declaration, the heads of state committed to reduce both stunting and underweight to less than 10% and 5%, respectively, by 2025. There is a significant gap in realizing this target.

2.3.3 SDG 2.3: Food production and increased income for small-holder farmers

The objective of SDG 2.3 is to double agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fisher folk, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment. It has two indicators – volume of production per labour unit and average income of small-holder food producer. Whereas the GOK 2019 SDG Report provided no data on this, indications are that Kenya is currently not performing well in the SDG target 2.3 as explained below:

a. **Food production:** The national production of most of the utilized crops have stagnated while the production quantities of cereals have been on a consistent decline. Challenges in the sector remain over dependence on rain-fed agriculture, low productivity, high costs of inputs, limited application of modern technology, land use, declining soil fertility and poor infrastructure

b. **Food crop importation:** Due to inadequate food production levels, Kenya has been importing food to meet the deficits. The country meets the needs of its people through both formal and informal imports of maize, rice and wheat (FAO 2016). Food insecurity is closely linked to historical under performance of the agricultural sector and the lack of consistent focus on food productivity and sufficiency at household level (FAO 2016).

c. **Productivity and income of Small-holder farmers:** There are around 4.5 million small-scale farmers in Kenya (including 3.5 million crop farmers, 600,000 pastoralists and 130,000 fisher folk). Collectively, their output accounts for about 63% of the national produce on approximately 90% of Kenya's land under agriculture (ASTS20). Most of the small-scale farmers have plots of 1.2 acres and operate at low productivity and consequently low income (source: ASDU 2019-2029). Unfortunately, the current level of productivity is low and therefore the income is also low. This situation is attributed to the following three challenges that can be addressed.

First, the small holder farmers have limited access to affordable, high quality inputs, mechanization and new technologies such as improved seeds, irrigation and artificial insemination. Secondly the varying quality and quantity of produce can lead to large post-harvest losses, leaving farmers with yields that are up to 5 times lower than their potential and finally poor access to market outlets. Whereas there are several SMEs that support the small-holder farmers, 70% of them lack finance, business advice and training opportunities and are struggling to attract and retain quality staff.

The targets for SDG 2.3. have been provided by the Big Four Agenda and the Kenya Agricultural

Sector Growth and Transformation Strategy 2019-2029 as follows: (a) to increase the production of the main food crops by between 67.5% (for maize) to 400% (for rice) by 2022, and (b) to increase the income of the smallholder farmers by 56% by 2022.

2.3.4 Sustainable Agricultural production (SDG 2.4)

The objective of SDG 2.4 is to ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, help maintain ecosystems, strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality. The gaps that are there in achieving the objective of SDG 2.4 are: decreasing soil fertility and productivity, the continued subdivision of land into unviable sizes, increased water stress and expanding desertification, competing land uses and low forest cover. (The SDGs Kenya Forum, 2019):

Whereas there is no specific target, the government through the Climate Smart Agricultural Strategy 2017-2026 has committed to achieving a long-term low carbon climate resilient development pathway that will be measured through the following indicators: Climate change adaptation investment in the agricultural sector, total agricultural sector greenhouse emissions, greenhouse gases emission per unit of agricultural GDP, and renewable energy investment in the agricultural sector.

2.3.5 Genetic Diversity (SDG 2.5)

The objective of SDG 2.5 is to maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed. Through the Kenya Agricultural and Livestock Research Organization Act of 2013, the government established a semi-autonomous entity known as the Genetic Resources Research Institute (GRRI) that preserves the genetic resources of plant, animal and microbial.

The broad mandate of the GRRI is to conserve plant genetic resources through germplasm collection, characterization, evaluation and generation of genetic materials, documentation and dissemination of plant genetic resources and data, capacity building and catalyzing the development of policies governing the conservation and use of plant genetic resources. Currently the gene bank has over 45,000 ascensions belonging to over 2000 crop species. For example, Kenya launched a major project to save the Northern White rhino from extinction.

Kenya is a signatory to the Nagoya Protocol (International agreement on access and benefit sharing from biodiversity) and as a results has in place benefit sharing regulations.[3] These regulations provide amongst others entitlements to Kenyan citizens of both monetary and non-monetary benefits arising from the right of access granted and the use of the genetic resources. Whereas there are no specific targets being pursued on this, there are few initiatives that are worth mentioning. In its organizational strategy, KALRO has set a target to conserve 19500 new plant genetic materials in the next five years (from 2022 to 2027). Kenya National Strategy and Genetic Resources within the context of Climate Change seeks to harness, conserve and promote greater and sustainable use of genetic resources for increased food security, resilience of

3 The environmental management and coordination (conservation of biological diversity and resources, access to genetic resources and benefit sharing) regulations 2006.

agricultural production systems, improved health and socio-economic advancement within the context of climate change.

2.3.6 Investment in Agricultural Research and Extension Services (SDG 2a)

The objective of SDG (2a) is to increase investments, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries. Kenya is currently spending 0.78% of the GDP on R&D activities against a target of 2%. In Kenya, the expenditure on agricultural R&D as a proportion of AgGDP has been on decline from 1.45% in 2006 to 0.5% in 2016.

The sector aspires a target of 2% expenditure of the AgGDP on agricultural R&D. The current ration number of farms per extension worker is 1000 farms [4]. The sector aspires to reduce the current ratio of farms per one extension worker from 1000 to 600 farms[5].

2.3.7 Food Price Anomalies

The objective of SDG 2c is to adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility. In 2016, the food price anomalies were 1.37 down from 8.7 in 2014[6]. This good performance is due to the following; the presence of national strategic food reserve that is funded annually through the government budget, and Several ICT driven market information initiatives on agricultural produces and their derivatives. The Government, under the Big Four initiative seeks to reduce the price of 2kg maize flour pack from $1.35 in 2017 to $0.9 in 2022. Similarly, the price of a kg of rice from $1.4 to $1.0 during the same period.

2.3.8 Programs and Initiatives addressing SDG 2

The implementation of SDG 2 is domiciled within the Ministry of Agriculture, Livestock, Fisheries and Cooperatives. The Ministry comprises four state departments and several Semi-Autonomous Government Agencies (SAGAs/Parastatals). Under the Constitution 2010, agricultural extension is a devolved function, while agricultural policy development, research and training are National Government functions. Agriculture is a key sector of the Economic Pillar of the Kenya Vision 2030. The Agricultural Sector Transformation and Growth Strategy – ASTGS (2019-2029) is the current Strategy guiding the development of the sector. It emphasizes the central role of Public-Private Sector Partnerships for the development of the sector.

Agricultural research is guided by the National Agricultural Research (NARS) Policy of 2012 and the Agricultural and Livestock Research (KALRO) Act of 2013. It also operates within the broad umbrella of the STI Policy and STI Act (Revised 2014). Notably, SDG 2 is consistent and closely aligned to the Comprehensive Africa Agriculture Development Programme (2015-2025) results

4 National Agricultural Investment Plan

5 National Agricultural Investment Plan

6 Department of Planning SDG Update Report 2019

framework which focuses on (a) wealth creation, (b) food and nutrition security; (c) economic opportunities, poverty alleviation and shared prosperity; and (d) resilience and sustainability.

The 'Big Four Agenda' on Food and Nutrition Security: According to the SDG Kenya Forum 2019 Report, the target on improving agricultural productivity and incomes of small holder farmers is expected to have the greatest impact on livelihoods. Focusing on this target has the greatest potential to ensure food and nutrition security, but also to improve on employment, incomes, and inputs for agro-industries. This view is shared by the Kenyan technical team on the STI roadmap for the SDGs.

The Big Four Initiative for Agriculture and Food Security had prioritized three pillars to be pursued during 2018-2022.These are enhance productivity and competitiveness in agriculture; driving small-holder farmer productivity; and reducing cost of food. These pillars focus mainly on SDG 2.3 but with direct impact on SDG 2.1, 2.2 and 2c. Increased productivity and competitiveness in agriculture was to be realized through increase acreage of large-scale production through PPP, promote irrigation agriculture and strengthen postharvest losses reduction and agricultural value addition.

On the other hand, enhancing the income of the small-scale farmers was to be realized through the following strategies: (a) Develop and enable farmer-facing SMES to provide more farmers with better access to affordable and appropriate inputs, irrigation equipment, improved post-harvest handling and aggregation and access to market; (b) enhance access to inputs by small-holder farmers through E-voucher system and (c) Other interventions include: fertilizer cost reduction, creating Disease Free Zones, increasing rice production, Reduce postharvest losses, and blue economy

a. **Kenya Livestock Commercialization Project (KeLCoP) (2021-2026):** The KeLCoP's overall goal is to contribute to the Government's agriculture transformation Agenda of increasing household incomes, and food and nutrition security for poor rural small-scale farmers. The project's development objective is to improve rural incomes of rural poor livestock and pastoralist households, by increasing their output and value addition, access to markets and their resilience to economic and climate risks.
b. **Kenya Climate Smart Agricultural Project (KCSAP) (2017-2022):** This is a 5 year project being implemented in 25 counties with support from the World Bank. Six counties from Arid Areas; Nine counties from Semi-Arid Areas; and 10 Medium-to-High Rainfall Areas. The development objective is "to increase agricultural productivity and build resilience to climate change risks in the targeted smallholder farming and pastoral communities in Kenya, and in the event of Eligible Crisis or Emergency, to provide immediate and effective response".
c. **The E-Voucher system:** To address the challenge of low yields, the government through the **Agriculture Sector Transformation and Growth Strategy (2019-2029) Flagship 2** sought to shift the nationwide impact support program focus to register 1.4 million high-need farming households and empower them to access a wide range of inputs from a variety of private and public service providers using e-vouchers with digital service delivery. This would be achieved by input subsidy support for various inputs, including fertilizer, lime, certified seeds, agro-chemicals, and insurance. In this regard, the e-voucher system, under the National Value Chain Support Program (NVSP) was designed to implement various activities geared towards supporting smallholder farmers to access a wide range of subsidized inputs through the e-voucher management system. The E-Voucher Program has already been rolled out in selected twelve counties.
d. **Kenya Agricultural Market Information System (KAMIS) (On Going):** KAMIS is a quick way for farmers, traders and processors to get regional market information anywhere, anytime,

easily using mobile phones or computers. KAMIS was developed to provide members and stakeholders with improved early warning marketing and trade information, leading to more efficient and competitive transactions in food trade between surplus and deficit regions. It provides real time, relevant and accurate information with national coverage of five markets in each of the forty-seven (47) counties The system captures more than 150 products with the capture of output market data (quantities) and wholesale, retail, and farm-gate prices for agricultural sector commodities (agriculture, livestock, and fisheries).

e. **Kenya Marine Fisheries and Socioeconomic Development (KMFSED) Project (2020-2025):** This project has four components: Component 1: Governance and management of marine fisheries and aquatic resources, whose objective is to strengthen marine fisheries and coastal aquaculture governance to control overfishing, maintain or improve stock productivity and enhance associated ecosystem integrity. Component 2: Promote investment in marine fisheries and coastal aquaculture whose objective is to promote efficient utilization and value addition of the resources by increasing investment in the marine fisheries and aquaculture sector. Component 3 – Strengthening Marine Fisheries and Aquaculture-based Livelihoods for Coastal Communities, which aims to enhance social and economic benefits that coastal communities derive from sustainable use of marine living resources. Component 4 - Project management.

f. **Aquaculture Business Development Programme (ABDP):** This program is jointly funded by the Government of Kenya and the International Fund for Agricultural Development (IFAD) and covers 15 counties with high aquaculture potential. The Programme is envisaged as national in scope but targeting counties with high concentrations of aquaculture activity, high production, existing sectoral infrastructure (processing, marketing and research), adequate water resources and marketing potential. The program development objective is to increase the incomes, food security and nutritional status of the wider communities of poor rural households involved in aquaculture in the targeted counties.

2.4 Sustainable Development Goals 9: Gaps, Targets and Programmes

The Kenyan STI for SDGs Roadmap also focuses on SDG 9 that aims at promoting sustainable industrialization, infrastructure and fostering innovation. The main objective of the SDG 9 is to promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries. In the overall assessment of the attainment of the SDG 9 targets, the global rating shows that Kenya is making moderate progress in areas such as increasing capital investments and credit facilities by the financial institutions. However, there are significant hurdles that Kenya still needs to overcome in order to attain the set targets for the sector. There has been a steady decline in the contribution of the manufacturing sector to GDP, from 8.7% in 2017 to 8.4%, 7.9%, 7.6% and 7.2% in 2018, 2019, 2020 and 2021, respectively. There is a significant reduction in the proportion of total employment accounted for in the sector over the same period. Moreover, the sub sector of agro-processing has been less explored in the expansion of the manufacturing sector resulting in low earnings to the country. This trend poses a significant challenge in achieving sustainable economic growth and employment creation. This calls for targeted interventions to reverse the trend and put the sub sector into a growth trajectory to promote value addition and exports as envisaged in the Kenya Vision 2030.

The SDG 9 indicators relevant to this work include the contribution of the manufacturing sector to the GDP, manufacturing employment as a proportion of the total employment, R&D expenditure as a percentage of the GDP and mobile and internet coverage.

Table 2.3 Summary of the status of various objectives under SDG 9

Objectives	Indicators	Performance				
		2014	2016	2018	2019	2019
Target 9.1. Develop quality, reliable, sustainable infrastructure	Proportion of rural population who live within 2 km of all season road, % (Indicator 9.1.1.)		61.4	69	69	
	Passenger and freight volumes (Indicator 9.1.2.)					
Target 9.2: Promote inclusive and sustainable industrialization	Manufacturing Value added as a proportion to the GDP in % (Indicator 9.2.1.)	10	8.7	8.4	7.9	7.4
	Manufacturing employment as a proportion of total employment (Indicator 9.2.2.)	12	12.31	12.16	12.07	
Target 9.3: Increase access to financial services and markets	Proportion of small-scale industries in total industry value added (Indicator 9.3.1.)					
	Proportion of small-scale industries with a loan or line of credit (Indicator 9.3.2.)					
Target 9.4: Upgrade all industries and infrastructure for sustainability **Target 9.5:** Enhance research and upgrade industrial technologies	CO2 emission per unit value added (indicator 9.4.1.)					
	R&D expenditure as a % of the GDP (Indicator 9.5.1.)	0.48	0.78	0.78		
	Number of researchers (in full-time equivalent) per million inhabitants (Indicator 9.5.2.)					
9.c.1.	% of population covered by mobile -2G in %	91	95	95		
9.c.1.	% of population covered by mobile - 3G in %	61	78	86		
9.c.1.	% of population covered by mobile - 4G in %			35		

Source: SDGs Status Report 2019 (Department of Planning)

2.4.1 Develop Quality, Reliable and Sustainable Infrastructure (SDG 9.1)

The overall Objective of SDG 9.1 is to develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, with a focus on affordable and equitable access for all by 2030. It has the following two indicators:

1. **Proportion of rural population who live within 2 Km of an all season road:** This indicator (commonly known as the Rural Access Index or RAI) measures the share of a country's rural population that lives within 2 km of an all-season road. The proportion of people living within 2km distance from an all-season road increased from 61.4% in 2016 and remained at 69% from 2017 to 2019 as a result of the effects of devolution of state power to 47 County Governments. This ensures that decisions are made closer to the local people, communities and businesses they affect. This indicator therefore shows positive trend
2. **Passenger and freight volumes, by mode of transport:** Under this indicator passenger and freight volumes are measured in passenger-km and tonne-km respectively and broken down by mode of transport. Passenger-km data are split between aviation, road (broken down between passenger cars, buses and motorcycles) and rail, and tonne-km are split between aviation, road, rail and inland waterways. There has been a consistent growth in this indictor until 2020 when there was a significant reduction in the volume of commercial air traffic passengers and cargo transported through various airports in 2020, what was attributed to covid.19 pandemic.

2.4.2 Promote inclusive and sustainable industrialization (Target 9.2)

The objective of the SDG 9.2 is to promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries. It has the following indicatorts:

1. **Manufacturing value added as a proportion of GDP and per capita:** Manufacturing value added (MVA) as a proportion of gross domestic product (GDP) is a ratio between MVA and GDP, both reported in constant 2015 USD. MVA per capita is calculated by dividing MVA in constant 2015 USD by the population of a country or area. In Kenya, MVA as a proportion of GDP was 8.7% in 2017 which decreased to 8.4%, 7.9% and 7.6% in 2018, 2019 and 2020 respectively. However, in terms of actual figures there has been consistent growth in both revenue from the manufacturing value added: a) Total manufacturing product grew from $123.1 billion in 2019 to $123.7 billion in 2020; b) Actual manufacturing value added has grown from $8.08 billion in 2019 to $8.18 billion in 2020. The big-four initiative had targeted to increase the contribution of manufacturing to the GDP to 15 % by 2022.
2. **Manufacturing employment as a proportion of total employment:** Employment comprises all persons of working age who, during a short reference period (one week), were engaged in any activity to produce goods or provide services for pay or profit. The working-age population is defined as all persons aged 15 and above. This indicator presents the share of manufacturing employment in total employment. In Kenya manufacturing employment as a proportion of total employment in the formal sector decreased slightly from 12.31% in 2017 to 12.16% and 12.07% in 2018 and 2019 respectively. The number of persons in formal manufacturing employment decreased by 10.3 percent between 2019 and 2020. There was a target to create additional 440,000 jobs in the manufacturing sector by 2022.

2.4.3 Increase access to financial services and markets (SDG 9.3)

The objective of SDG 9.3 is to increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets. The following indicators fall unde this objective:

1. **The proportion of small-scale industries in total industry value added:** Recognizing the critical role played by MSMEs in creating employment, the Government has made a deliberate effort to emphasize the growth and development of these enterprises as part of the "Big Four Agenda", which focuses on manufacturing, increased food security and nutrition, universal health care and provision of affordable housing. In addition, The Third Medium Term Plan (MTP III) of the Kenya Vision 2030 recognizes the need to facilitate increase in the productive investment initiatives to eliminate barriers to lending and investment by the MSMEs. The National Treasury has established a Credit Guarantee Scheme (CGS) aimed at supporting MSMEs to access quality and affordable credit, stabilizing the market and protecting jobs by enabling the MSMEs to access appropriate financing through provision of affordable credit in efficient and structured manner.
2. **The proportion of small-scale industries with a loan or line of credit:** Extension of credit to manufacturing is an important pillar in driving the growth of the manufacturing sector especially for start-up businesses and the MSMEs that are seeking transition into established industries. The realization of sustainable and meaningful industrial development in the country requires access to affordable long-term finance and credit facilities that have remained a challenge to the MSMEs inhibiting their production and technological expansion.

The government injected an initial KSh.3 billion seed capital for the inaugural Credit Guarantee Scheme towards the MSMEs which is expected to be increased to KSh. 10 billion in the medium term. Participating banks are expected to leverage this amount four times, once the capital increases to KSh. 10 billion, then the resultant credit available to MSMEs will increase to KSh. 40 billion. The Credit Guarantee Scheme for MSMEs is being delivered through a risk sharing agreement between the Government and 7 participating banks. The seven banks are KCB, Cooperative Bank, Absa Kenya, DTB, NCBA, Stanbic and Credit Banks.

2.4.4 Enhance research and upgrade industrial technologies (SDG 9.5)

1. **Research and development expenditure as a proportion of GDP:** According to Frascati Manual 2015 edition, research and experimental development (R&D) comprise creative and systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge. The proportion of the national research and development expenditure as a proportion of GDP rose by 0.0061 % from 0.0009 percent in 2016 to 0.007 percent in 2018.
2. **Researchers (in full-time equivalent) per million inhabitants:** The researchers (in full-time equivalent) per million inhabitants is a direct measure of the number of research and development workers per 1 million people. The number of full time industrial researchers in the public sector fell from 31 per million inhabitants in 2016 to 28 per million inhabitants in 2018 mainly due to higher incentives in the private sector.
3. **Proportion of population covered by a mobile network technology (Indicator 9.c.1):** The proportion of the population covered by a mobile network, broken down by technology, refers to the percentage of inhabitants living within range of a mobile-cellular signal, irrespective of whether or not they are mobile phone subscribers or users. This is calculated

by dividing the number of inhabitants within range of a mobile-cellular signal by the total population and multiplying by 100.

In Kenya, the proportion of the population covered by a mobile network has remained at 95 percent (2G) in 2017 and 2018 but it increased slightly to 96 percent in 2019. 3G coverage increased from 85 percent in 2017 to 86 percent in 2018, and to 93 percent in 2019. Coverage of the fourth generation (4G) network increased by 42.0 per cent to 25,191 transceivers in the country.

2.4.5 Programmes that support the realization of SDG 9

The contribution of the manufacturing sector to the national GDP has been on decline in recent years from 9.3 % in 2016 to 7.6 % in 2020 (KNBS Economic Survey 2021). Considering that Kenya seeks to explore opportunities and improve the GDP contribution of this sector, active efforts are in place to improve its performance. The following are some of the programmes that are aimed at addressing the declining contribution of the manufacturing sector to the GDP and the national economy:

The Big Four Initiative for the Manufacturing Sector (2018-2022)

This Initiative put a target of increasing the contribution of the Manufacturing Sector to the GDP from 9.2% in 2017 to 15 % in 2022. The vision for the manufacturing sector has outlined the following targets to realize this objective and target:

1

Textile and apparel/Cotton:

Increase revenue from the sector from US$ 350 million to US$ 2 billion; create 50,000 new jobs in cotton sector and 100,000 new apparel jobs

2

Leather sector:

Increase revenue from US$ 140 million to US$ 500 million exports, create 50,000 jobs and make 20 million shoes

3

Agro processing: Increase the contribution of agro-processing to the manufacturing GDP from 16 % to 50 % and create 200,000 new jobs

4

Construction materials:

Increase investment in the sub-sector from US$ 470 million to US$ 1 billion. Create 10,000 new jobs

5

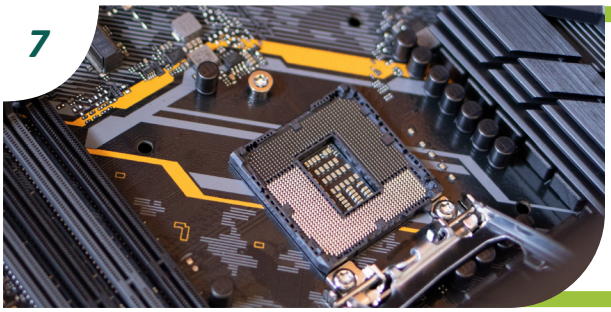
Oil, Mining and Gas: Attract at least 1 global scale player in mining value addition

6

Iron and Steel:

to attract US$ 1 billion in new investments

7



ICT:

promote phone, laptop, TV assembly plants, create 5 BPO players and create 10,000 jobs

8

Fish processing:

Fish processing attracts US$ 20 million fish feed mill investment. Create 20,000 jobs

Industrious Parks

The culture of industrialization through the use of Industrial zones is picking up in Kenya due to the incentives that are being provided to Investors by the Government. The industrial Parks normally use infrastructure serviced with utilities such as energy, water, roads, rails, Information Communication Technology (ICT), ports and airports; which play a critical role in facilitating and accelerating industrial development. Land is a key driver of rapid economic transformation. Ease of access to land and affordability of land are essential ingredients to growth in industrial investments and decent and affordable housing, especially within the Special Economic Zones (SEZs), industrial parks (IPs) and SME parks. These Industrial zones consist of Export Processing Zones (EPZs), Special Economic Zones and Industrial Parks that can either be Public or Private sector owned.

The publicly run zones include the Dongo Kundu SEZ (3000 Acres), Naivasha SEZ (1000 acres), Konza Technopolis SEZ (5000 Acres), Kisumu SEZ (1000 acres), Lord Egerton Agrocity (200 acres) and Lamu SEZ (1243 Acres). According to the 2021 Economic Survey, there are a total of 76 Public and private EPZs in Kenya with the Athi River EPZ being the largest public EPZ in the country. In 2020, the EPZ programme recorded a positive growth in most of the EPZ performance indicators that included a number of gazetted zones, local employment, investment and domestic expenditure. The Kenya Green Energy Park stands on a 453 hectares piece of land located in Naivasha and managed by KenGen. It is available to manufacturers who can tap on cheap power from steam.

In order to promote sustainability, these industrial zones should be converted into eco industrial parks (EIP). EIPs are modeled on the green and circular economy concepts that prioritize resource use efficiency, low carbon development pathways and social inclusion through the creation of decent green jobs. EIPs are characterized with enhanced energy & water use efficiency, waste minimization and management as well as adoption of renewable energy solutions such solar, wind, geothermal and biomass.

The Ministry of Industrialization in collaboration with UNIDO is establishing an Integrated Agro-Industrial Park (IAIP) in Nyamira County, on a 265 acre land. The Nyamira IAIP will also work with 8 other surrounding counties (Vihiga, Kisumu, Kisii, Kericho, Bomet, Narok, Migori and Homa Bay) with 3 Rural Transformation Centres and 5 Aggregation Centres. PCP targets to support six (6) regional Integrated Agro-Industrial Parks in Kenya considering regional resource endowment. The government, as part of revitalizing & modernizing Strategic Industries and developing the Cotton Textile and Apparel (CTA) sub sector, embarked on the modernization of Rivatex East Africa Limited (REAL) and Revitalization of cotton production. REAL is an integrated textile mill that has four textile production departments namely spinning, weaving, processing, apparel and tailoring departments.

Currently, it has the capacity to process 20 tonnes of cotton lint and produce 40,000 meters of finished fabrics per day. It is reputed as the home of quality textile products both locally and regionally. Rivatex today is playing a major role in Kenya by supporting backward and forward linkages. This is realized through creating ready market and extension services for cotton farmers as well as supporting Small and Medium Enterprises (SMEs) in the textiles value chain through supply of fabrics and technical support. As of 2021, the modernization was at 92% completion. REAL is also developing two value addition and training centers at Kieni and Nyando in Nyeri and Kisumu Counties respectively.

The government in efforts to promote value addition, increase products' shelf life, and address the challenge of post-harvest losses has built cold storage facilities in Kisii for Bananas, Nyandarua

and Meru for potatoes. As of 2021, the main buildings for the two sites were complete, while the Kisii one was at 95% completion. The process of procuring equipment is ongoing. These facilities are being managed by the Micro and Small Enterprises Authority (MSEA). More of such will need to be put up in other areas and for other products as a way of enhancing value addition and agro-processing.

Further, the involvement of MSMEs in socio-economic development is very critical and draft policy documents have been developed in support of their roles in job and wealth creation. Some of these drafts include the sub-contracting policy, Incubation policy, industrial cluster development policy, 5K MSE Technology transfer strategy and the Development of cottage Industries through the One Village One Product (OVOP) initiative . All these, if finalized, will provide the necessary impetus for their sustainable development and growth.

2.5 STI Entry Points to address Identified Gaps

This section presents the possible strategic areas for interventions using Science, Technology and Innovations (ST&I), in order to contribute towards addressing the gaps identified in SDG 2 and SDG 9. The entry points provide feasible solutions to be adopted as realistic strategies in accelerating the achievement of the SDG targets.

2.5.1 STI Entry points to address identified gaps for SDG 2

1. End hunger and ensure access by all to safe, nutritious, and sufficient food (SDG 2.1)

The identified gaps in this target can be addressed by deploying technologies that can lead to: increasing access to affordable fertilizers, enhancing food production and safety; reducing pre- and post-harvest losses; promoting peri-urban and urban agriculture; increasing participation of Youth and Women in modern agriculture.

2. To end all forms of malnutrition for all the marginalized population (SDG 2.2)

The STI intervention to accelerate attainment of this target will include: food fortification and bio-fortification; new varieties and breeding; diversification and value additions of emerging value chains; leveraging STI to strengthen commodity value chains and making products accessible to people; affordability, ownership and inclusivity.

3. Double agricultural production and incomes of small-scale farmers (SDG 2.3)

To increase productivity of small-scale holders, numerous gaps were cited. These include: - Limited access to inputs; Low-quality breeds and varieties; Limited access to technologies; Over-reliance on rainfed agriculture; Small farm sizes; pests and diseases; Minimal farm mechanization; Low empowerment of women and youth; Limited access to data; inadequate extension services; Limited product diversification and High postharvest losses.

The identified STI entry points to address these gaps will include: - enhancing access to affordable fertilizers; Improving farm income and livelihoods through diversification and value addition of

emerging value chains; Enhance access to affordable financing; Increasing investment in disease and pest control; promoting crops, fisheries and livestock insurance; Digitization of value chains; supporting market innovations and supporting smallholder farmers to be innovators and entrepreneurs, commercialisation of agriculture by providing market information and improving food distribution, soil conservation.

4. To ensure sustainable food production systems (SDG 2.4)

In ensuring sustainable production, there are limited agro ecological practices and limited crops and livestock intensification. To address these gaps the STI intervention will include: - Promoting Climate Smart Agriculture (CSA); Circular innovations and improving bio products innovations and revitalizing and modernizing strategic industries.

5. Genetic Diversity (SDG 2.5)

The objective of SDG 2.5 is to maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional, and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed.

In addressing genetic diversity and access sharing of benefits, some of the identified gaps include: - Inadequate infrastructure and land for conservation in-situ and ex-situ at the gene bank; Inadequate finances (e.g. for databases); Inadequate human resources; Lack of agricultural ITK platform(s) for crop and livestock germplasm; Limited enforcement of bio piracy and IP laws; and limited awareness and capacity on conservation and material/information transfer agreements (MITAs) and protocols. To address these gaps, some of the proposed STI interventions will include: increasing investments in the acquisition and development of modern equipment for conservation; Molecular profiling of indigenous crop and livestock germplasm; Capacity building on enforcement of various bio piracy/IP laws and Digitization of crop and livestock germplasm and ITK.

6. SDG 2.5. (2a)

The objective of SDG 2.5 (2a) is to increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development, and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular the least developed countries. In this target, the gaps included: - Inadequate infrastructure for agricultural R&D across the country; Inadequate agro-processing facilities and Lack of partnerships framework to enable different R&D and extension institutions to work together.

The suggested STI entry points to address these gaps include: Modernizing STI infrastructure across the counties, develop, validate, package and upscale technologies/ innovation for agro-processing for different regions; Strengthening the partnerships among the R&D institutions and extension service delivery and Revamping of extension information databases

7. SDG 2.5. (2c)

The objective of SDG 2.5 (2c) is to adopt measures to ensure the proper functioning of the food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility. The gaps identified in this target included: - Inadequate access to market information; Limited processing/value addition of agricultural products and most agricultural products are sold in the domestic/ international markets in raw form. The needed STI interventions include: - Develop and use ICT apps to provide updated market information on a timely basis for different products; Strengthening price trends monitoring and sharing system and Promote value addition technologies and cottage industries in the rural areas and economies.

2.6 STI Entry point for SDG 9

SDG 9.2: Promote inclusive and sustainable industrialization

In this target, there are gaps in the limited implementation of policies that promote commodity-based industrialization that is not sustainable and the low levels of adoption of green manufacturing practices. In order to bridge these gaps STI entry points suggested in include: -Ensuring adequate resourcing and incorporation of the ideals of sustainability in value chains; Reviewing the Green Economy Strategy and Implementation Plan (GESIP-2016-2030) to incorporate green manufacturing practices and embracing inclusivity; Promoting Indigenous Technical Knowledge (ITK) in agro-processing; Providing support systems for sustainable development of MSMEs sector through STI and Strengthening linkages between MSMEs and large enterprises.

SDG 9.3: Increase access to financial services and markets

In this target, there are some limitations to access to financial services and markets. These include : Limited access to finances; Collateral limitations and Lack of green credit lines. To address these gaps, the following STI interventions will be employed:- Raise awareness on available financial mechanisms including FinTechs, Credit guarantee schemes; Promote social innovations - organized groups accessing credit through self-guarantees; Create credit lines to support green solutions; Accelerate access to green bonds (KCB); Promote e-commerce for market accessibility; Promote Eco-labeling; Improve product quality and standards such as (ISO, GEMBA-KAIZEN 5S); Promoting the use of barcoding and Trade Fairs Exhibitions.

SDG 9.4: Upgrade all industries and infrastructures for sustainability

The challenges faced in this target included: - Obsolete technologies and inadequate supporting infrastructure. These could be addressed through: - Adoption of modern technologies and support technology transfer; Development of STI infrastructure sharing framework; Establishing industrial zones; Development of special economic zone and industrial parks; Strengthen governance structure and developing and strengthening incubation and accelerator support programmes

SDG 9.5: Enhance research and upgrade industrial technologies

Some of the gaps identified in this target include: - Mismatch between skills and knowledge developed at teaching and learning institutions and the needs of the industry; few researchers in the private sector; limited funding; Limited technology transfer and IP utilization and commercialization and Limited access software e.g. process optimization, design and modeling. Some of STI entry points to address these gaps could include:- Establishment and constant review of prioritized research themes; Mainstream innovation studies at local Universities and TVET institutions; strengthening quadruple helix framework to enhance linkages between key stakeholders in R&D (Academia, Government, Industry and users); Create incentives for the private sector to promote research; Promote technology transfer and commercialization of research outputs; Strengthen Resource mobilization mechanisms (Govt and private sector); Development of special economic zone and industrial parks

2.7 Gaps Identified in the ST&I sector

To deploy STI to a scale that can have the highest widespread impact on the prioritized SDGs 2 and 9, there are challenges in the STI sector that this roadmap will need to address. These are presented in this section.

2.7.1 Inadequate financing for STI

The Science, Technology and Innovation Act of 2013 (Revised 2015) has created the National Research Fund (NRF) to coordinate the government funding of research and innovation activities in the country. The ST&I Act provides for at least 2 % of the GDP to fund research and development. According to UNESCO Report & Science System reports of 2019, it was estimated that R&D financing by the government was around 0.77% of the GDP below the target limit. This is a decline from the 0.89% reported in 2010.

2.7.2 Mismatch of skills and low demand for STI

Training in relevant STI skills that match the needs of the industry is still a challenge. In addition, local demand by industry for relevant skills and knowledge in STI emerging from local research and academic institutions of higher learning by local industries is still low. This is attributed to several factors. For instance, it has been argued that there is a disconnect between the skills possessed by the labor force and those that are required by industry. This has a negative impact on productivity of the labor force, especially manufacturing including agro-processing and ICT, which could slow the country's industrialization agenda. Other factors include low industrial base, low appreciation of the importance of technology for industrial competitiveness, and the informal nature of the small and medium enterprises that constitute the bulk of the industries in Kenya.

2.7.3 Inadequate Alignment of Research Activities to the National Development Goals

The Kenya Vision 2030 envisages intensified generation and application of new knowledge to propel the transition to a knowledge-based economy. Efforts to align research activities to the national development goals have been made through development of the National Research Priorities (2018-2022). The mechanism proposed to support implementation of the research priorities was not fully operationalized, thus limiting the extent to which they were disseminated,

implemented, funded and monitored. Initiatives supporting alignment include the performance contracting framework and the National Research Fund adoption of a multidisciplinary and consortia model that requires grantees from diverse disciplines to coalesce around one national thematic area.

2.7.4 Limited integration of innovation in the business system

The private sector in Kenya accounted for 67.7% of the total wage employment in 2020, with agriculture and manufacturing as the highest employers among the industries standing at 15.1% and 15.8%, respectively (Economic survey 2021). In order to sustain the performance of the private sector, it is important that innovation be integrated in its operations and systems. However, recent statistics show that the contribution to financing of STI from the private sector (for-profit organizations) still remains remarkably low in Kenya, estimated at 4.3% of the total expenditure on R&D (WIPO 2021). This figure is remarkably low as compared to the global leaders as per the innovation report, Switzerland, whereby the private sector contributes up to 68.6% of the total GERD. However, the level of financing reported by the private sector is higher than the proportion reported in Mauritius (4.1%) that ranks highest in SSA in the global innovation report. Moreover, the business system has not fully integrated innovation to enhance its competitiveness. The Kenyan industries, which include start-up companies, MSMEs and a few large companies, do not have structures and policies to support acquisition and exploitation of innovations.

2.7.5 Weak institutional linkages

In Kenya, ST&I sector is hampered by the limited linkages between industries, research and training institutions. Further weak institutional mechanisms for promoting collaborative research have constrained commercialization of research outputs. On a score of (0-100), Kenya University-industry research collaboration score was reported to be at 54.9 (Outamba & Bechcen, 2020). To strengthen these linkages and partnerships, there are a number of initiatives both by the Government and the private sector such as the Linking Industry with Academia (LIWA) that seeks to ensure academia develops skilled and relevant human capital that is critical in driving Kenya'sVision 2030. Fostering the quadruple Helix interactions, between Academia, Industry, Government and Civil society/users is key to bridging the gaps.

2.7.6 Limited infrastructure and support systems for STI

As of 2022, the Kenyan government had set aside land for the construction of industrial parks in Taita Taveta and Eldoret and had conducted pre-feasibility studies for the construction of SEZs in Dongo Kundu, Mombasa in the effort to expand the support infrastructure for the STI sector in the country. The government has also set up the Ajira Digital project that aims to provide training to 10,000 youth in the effort to bridge the gap between skills demand and lack of jobs in the country.

In addition, the country is improving the STI infrastructure such as industrial and science and technology parks and the constituency innovation hubs and upgrade of infrastructure in research institutions. For instance, the designs for national science and technology parks at Konza Technopolis and the Dedan Kimathi University of Science and Technology were finalized while the development and construction work at Dedan Kimathi was 30% complete in the period 2017-2022. However, the available STI infrastructure is still inadequate to support the conversion of STI products, processes and technologies into business towards full scale commercialization.

2.7.7 Inadequate management of Intellectual Property Rights

Kenya has a robust institutional framework that is responsible for intellectual protection, comprising the Kenya Intellectual Property Institute - KIPI, Kenya Plant Health Inspectorate Service - KEPHIS, Kenya Copyright Board - KECOBO and Anti-Counterfeit Agency - ACA. There is however low level of awareness on intellectual property and limited utilization of the available institutional support structures in the country as demonstrated by the low number of patent applications and those granted to Kenyan citizens. In 2019, for instance, out of the 28 granted patents, only 5 were allocated to Kenyans. Kenya currently ranks 6th out of 21 Sub-Saharan countries and bottom of global rankings (90th among 119 countries). Even at the national level the number of patents per million inhabitants filed under the Patent Cooperation Treaty (PCT) was at 0.2 although this has been increasing over time.

2.8 Strategic issues to be addressed by the STI for SDGs Roadmap

The expectations are that, the potential STI interventions identified will contribute to accelerating the attainment of the identified SDGs targets. These set out the connecting entry points for STI and the SDGs in this roadmap. These mapped out potential STI entry points to address identified gaps in the SDGs targets set out the strategies to accelerate the achievement of SDGs aspirations using STI, and provide a guide to identifying the key actors in this process. The situation analysis has identified the following eight strategic issues that will need to be addressed in the roadmap.

2.8.1 Sustainable Development Goal 2: End Hunger

Under Sustainable Development Goal 2: End Hunger, the analysis has shown that there are enormous gaps in realization of all the targets of SDG 2 and has identified the following four (4) key strategic issues that should be pursued in the STI roadmap.

1. **Limited production of food crops, livestock, and fisheries:** This strategic issue is important since interventions will significantly contribute to addressing the problem of food deficit, access and affordability and nutrition. This will contribute towards addressing the SDG 2.1 (food and nutrition security), and SDG 2.2 (Stunting and Malnutrition).
2. **Low productivity and income of small-holder farmers:** This challenge faces around 4.5 million small-holder farmers in Kenya, who account for over 63% of national produce. This challenge speaks directly to the SGD 2.3. Furthermore, increasing productivity will directly contribute towards increasing production, which will contribute towards addressing SDG 2.1 and SDG 2.2.
3. **Impact of climate change to sustainable agricultural production.** Due to climate change and unsustainable agricultural practices, Kenya is experiencing decreasing soil fertility and productivity, increased water stress and expanding desertification and decreasing forest cover. Interventions in this area will have direct impact on the realization of SDG 2.4 and indirect impact to SDG 2.1, 2.2 and 2.3.
4. **Limited participation of youth in agriculture:** The current agricultural practices is dominated by subsistence farming, which is not appealing to the youth. Transformation of agricultural production from subsistence to agriculture as a business will require increasing the participation of the youth in modern farming. The attractive point for youth in agriculture is technology. The involvement of youth in modern farming and related services will increase

production, productivity and income and therefor contribute to SDGs 2.1 to 2.4.

2.8.2 Sustainable Development Goal 9: Infrastructure, Industry, and Innovation

The situation analysis has identified the main challenge facing the SGD 9 is the ever-declining contribution of the manufacturing sector to the GDP, from 10% in 2006 to 7.6 % in 2019. This means that Kenya is moving away from realizing the Kenya Vision 2030, which hopes to convert Kenya into an industrialized middle income country by 2030. The trend is even worrying given that the Big-Four Initiative for the manufacturing sector (2018-2022) had a target of realizing at least 15 % contribution of the sector to the GDP. Based on the situation analysis, the key strategic issues for this sector include:

1. **Low market share and stiff competition:** Kenya's export to the world market is made up of semi processed, raw and predominantly agricultural products. These products face low and fluctuating prices and are subjected to a number of access limitation which drastically reduce the country's share of the global market. Furthermore, liberalization has exposed the domestic market to stiff competition and un-balanced competition from the developed countries due to their superiority in the use of advanced technology and ability to subside production. There is therefore need to increase the productivity and competitiveness of the Kenyan industries to increased export market share and manage domestic competition and thereby increase the revenue from the manufacturing sector.
2. **Low level of value addition:** Forty percent (40%) of Kenya's exports is unprocessed while 60% is semi-processed. Lack of strong forward and backward linkages have led to wastage, particularly of the agricultural perishable goods. The trading in semi-processed products such as tea and coffee, which fetch low international prices, has resulted into low returns and exportation of jobs. Furthermore, there is limited enterprises sub-contracting.
3. **Large informal sector in the economy:** The bulk of Kenyan manufacturing industries are found in the industrial clusters spread across the big urban areas. Most of these enterprises are informal and are not able to fully comply with stringent standards requirements resulting. Furthermore, they have challenges in accessing technologies to help them improve on their productivity, and in most cases, their products are not branded. All these lead to a reduced market access.
4. **Low level of research, innovation, and technology development:** Due to the STI gaps identified in section 2.6, the low level of innovation and use of outdated production systems has led to low productivity and competitiveness of Kenya's industries. Furthermore, the low level of awareness of the role of intellectual property rights in fostering socio-economic development is hindering the development, commercialization, registration and protection of new innovations in the manufacturing sector. The country needs to improve its competitiveness, productivity, and product quality through adaptation of appropriate technologies and certification.

3. CHAPTER THREE: STRATEGIC THRUST OF STI FOR SDGS ROADMAP

This chapter presents the Vision, Mission, Goal, and key result areas to guide the implementation for the STI for SDGs Roadmap. It further outlines the strategic objects to be pursued and the strategies for achieving them. The strategic objective responds to the gaps identified in implementing SDGs 2 and 9, and therefore aims to accelerate the realization of the targets under these goals.

3.1 Vision

Science Technology and Innovation-driven Agriculture and Manufacturing sectors. This vision was developed through consensus by stakeholders in a workshop. The vision is aligned to Kenya's Big Four Agenda that targets food security, affordable housing, universal health care, manufacturing, and job creation. The agenda will ensure that ordinary citizens have secure employment, have a reliable source of livelihoods, own decent homes, have enough food and have access to universal health coverage.

3.2 Goal

To accelerate the realization of Sustainable Development Goals (SDG) through STI.

3.3 Key Result Areas

Kenya has made tremendous progress in realizing various SDGs targets, although some targets are lagging behind. This roadmap will aim to transform the key areas in agriculture and

manufacturing to hasten progress in the targets where little progress has been made and which are likely to hinder the country's achievement of the SDGs by 2030. Selection of the key result areas is informed by the gaps identified in prioritized SDGs implementation and the resultant strategic issues that arose from situational analysis. The following key result areas are identified to guide the application of STI in the roadmap.

3.3.1 Key Result Area 1: Productivity and Competitiveness Improved

Low productivity in agriculture and manufacturing constraints Kenya's progress to meeting SDGs 2 and 9. Despite a number of policy and technological initiatives to boost productivity in these sectors, the overall productivity remains low. This roadmap will implement strategies to improve productivity and competitiveness through STI focusing on areas where the country has comparative and competitive advantages and which will produce the greatest widespread impact on the SDGs targets.

3.3.2 Key Result Area 2: Sustainable production

Promoting sustainable development and production are overriding tenets of the SDGs, and a key result area for the roadmap. Sustainable development is already embedded in many policies and legislations in Kenya, yet there are opportunities for the country to reap the benefits accruing from full integration of the sustainable development principles across all sectors of the national economy. The roadmap will seek to scale up good and best practices that have successfully been piloted in the country's agriculture and manufacturing sectors while ensuring their adoption along the value chains.

3.3.3 Key Result Area 3: Value addition

Agriculture accounts for 40% of raw material inputs for the manufacturing sector in Kenya. Analysis of the main value chains show weak linkages in these sectors leading to unexploited opportunities. If Kenya is to make strides towards meeting the targets for SDG 2 and SDG 9 targets investing in agro-processing will be essential. Given that agriculture is characterized by small scale farming, and is dominated by rural women, investing in value addition will contribute to employment and women empowerment thus contributing to attainment of SDG 1, SDG 5 and SDG 8) and their interconnected nexus.

3.3.4 Key Result Area 4: Technology Transfer and Commercialization of R&D Outputs

Technology including indigenous knowledge play a significant role in achieving SDGs by improving the efficiency and effectiveness of new and more sustainable ways of production and consumption. Investing in technology development and transfer, foster research and stimulate innovation are important measures towards achieving SDGs. Deployment of technology in agriculture and manufacturing remain low resulting in low productivity, making the country uncompetitive. This result area will aim to achieve effective utilization of technology to address barriers to and provide solutions to problems bedeviling these sectors across scale. Technology will play an essential role in strengthening linkages between the sectors and SDGs. Emphasis will be given to promoting indigenous traditional knowledge (ITK) and emerging technologies that are readily accessible, easy to adopt and less costly.

3.3.5 Key Result Area 5: Involvement of Youth in Agriculture and Manufacturing

Young people should not be mere beneficiaries of the SDGs, but rather be at the core centre of their implementation. According to the Kenya Youth Agribusiness Strategy, youth account for 35.4% of Kenya's population, with about 1,000,000 entering the labour market annually. These offer a dynamic workforce that is innovative; have a high uptake of technological know-how and ready to take significant levels of risk. Huge opportunities exist in agriculture and manufacturing to absorb the youth and ensure achievement of food security and value addition. Although some progress has been made to shift the youth to agriculture, many consider the sector unattractive. The sector is perceived as a career of the last resort, one of drudgery and having low returns.

The roadmap will aim to address challenges hindering adequate engagement of the youth in agriculture and manufacturing sectors, to enable them to take their rightful positions and play lead roles in in SDGs implementation

3.4 Strategic Objectives and Strategies

The vision of this STI for the SDGs Roadmap will be realized through the 13 strategic objectives presented in Table 3.1: below:

Table 3.1: Strategic objectives to be pursued under STI for SDG Roadmap

S/N	KRA	Strategic Objectives
1.	Productivity and competitiveness Improvement	**1.** To increase production of food crops **2.** To increase productivity and income of small-holders farmers **3.** To increase productivity and competitiveness of local industries and enterprises
2.	Sustainable production	**1.** To increase sustainable agricultural production practices **2.** To increase sustainable manufacturing practices
3.	Value Addition	**1.** To promote agro-processing and value addition **2.** To promote reduction of pre and post-harvest losses **3.** To promote and develop special economic zones and industrial parks
4.	Technology Transfer and Commercialization of R&D Outputs	**1.** To promote the use of intellectual property rights **2.** To enhance commercialization and technology transfer **3.** Strengthen the innovation and startups ecosystem

5	Involvement of youth in agriculture and manufacturing	1. To enhance the participation of youth in modern agriculture and input supply 2. To enhance participation of the youth in agro-processing, value addition and related manufacturing/ enterprises

3.4.1 Key Result Area 1: Productivity and Competitiveness Improvement

Under this result area, the following three strategic objectives will be pursued: increase productivity and income of small holder farmers; and increase productivity and industrial competitiveness of local industries and enterprises.

Objective 1: Increasing production of food crops

Increasing agricultural production is key to address undernourishment, food insecurity, stunting and obesity. Challenges of production of food crops remain overdependence on rain-fed agriculture, low productivity, high costs of inputs, limited application of modern technology, land use, declining soil fertility and poor infrastructure. This STI for SDGs Roadmap will address these challenges by pursuing the following strategies:

1. Enhance access to affordable fertilizers through promotion of small-scale local production of fertilizers including organic fertilizers.
2. Developing and deployment of ICT driven soil fertility measurements tools and ICT driven fertilizer use advisory services
3. Developing and deployment of disease and pest control detection ICT tools and disease and pest control advisory services
4. Promote peri-urban and urban agriculture technologies and develop and implement policy guidelines and incentives for the urban agriculture.

Objective 2: Increasing productivity and income of small holder farmers

Kenyan smallholder farming is characterized by low productivity what leads to low income to the smallholder farmers. This is due to the three factors. First is that small holder farmers have limited access to affordable, high-quality inputs, mechanization, and new technologies such as improved seed, irrigation and artificial insemination. Second, the varying quality and quantity of produce can lead to large post-harvest losses, leaving the farmers with low yields which are up to 5 times lower than their potential and finally access to market. Finally, there are several SMEs that support the small-holder farmers, 70 % of them lack finance, business advice and training opportunities and are struggling to attract and retain quality staff. The STI for SDGs Roadmap will address these challenges by pursuing the following strategies:

1. Promoting and investing in modern and affordable irrigation technologies to increase acreage under irrigation.
2. Enhance access to farm inputs through the e-voucher system
3. Identify and deploy technologies for reduction of post-harvest losses throughout agricultural, livestock and fisheries value chains

4. Promote the establishment and growth of youth and women owned farmers-facing enterprises to support small holder farmers.
5. Promote the uptake of aquaculture technologies as well as cage-fishing and seaweeds technologies.
6. Promote the use of modern technologies for yield and disease predictions to enhance the participation of private sector in for crops/fisheries/livestock insurance
7. Enhance use of integrated pest management practices (bio-pesticides, biological control, push and pull technologies)
8. Adopt and strengthen usage of digital surveillance within counties in identifying pest and disease infestation.
9. Improve farm income and livelihoods through diversification and value addition of emerging value chains

Objective 3: Increasing productivity and competitiveness of local industries

Kenya's local industries are characterized by low productivity and competitiveness. This is attributed to old equipment and obsolete technologies, limited access to modern technologies, weak linkages between MSMEs with large industries, and lack of standards in the predominantly informal enterprises. There is need to increase the productivity and competitiveness of the Kenyan industries to increased export market share and manage domestic competition and thereby increase the revenue from manufacturing. The roadmap will address these challenges by pursuing the following strategies:

1. Strengthen linkages between MSMEs and large enterprises through subcontracting and finalize sub-contracting policy
2. Enhance access to technologies by MSMEs in the industrial clusters by strengthening the linkages between the clusters and academia
3. Promote support system for sustainable development of MSMEs sector
4. Develop a sustainable strategy on the 5K MSE technology support initiative
5. Prioritized and scale up existing technologies
6. Improve product quality and standards through ISO and related standards certification schemes and protocols
7. Promote use of bar coding
8. Enhance access to locally developed technologies for agro-processing
9. Revitalize and modernize collapsed strategic industries
10. Operationalize the MSE Fund under the MSE Act 2012

Implement the Credit Guarantee Scheme under National Treasury and Economic Planning and Ministries of Trade and Industrialization and Enterprise Development.

3.4.2 Key Result Area 2: Sustainable Production

Under this result area, the following two strategic objectives will be pursued: increase sustainable and all-inclusive agricultural production; and promote sustainable manufacturing.

Objective 4: Increasing sustainable and all-inclusive agricultural production

Climate change will continue to impact negatively to agricultural production since it leads to vulnerability due to droughts, floods, decreasing soil fertility and productivity, increased water stress and expanding desertification. This roadmap will address these challenges by pursuing the following strategies:

1. Increased development and deployment of weather forecasting technologies
2. Promote use of modern technologies to develop pest, disease and drought resistant crop varieties and livestock breeds
3. Increased development and deployment of water storage and reuse technologies
4. Promotion of climate smart agriculture including uptake of smart agricultural technologies and precision agriculture.
5. Promotion and adoption of renewable energy based drying and cooling technologies

Objective 5: Increasing sustainable Manufacturing

The roadmap will address these challenges by pursuing the following five strategies: promote green and circular economy, revitalize and modernize strategic industries, promote the development eco-industrial parks, develop an incentive structure for PPP in deploying technologies for energy efficiency in industries, promote eco labelling, and improve access to Climate Fund established by the climate change Act, 2016.

3.4.3 Key Result Area 3: Value Addition

Objective 6: To promote agro-processing

This objective will be achieved through the following six strategies:

1. enhancing the use of digital technologies in agricultural mechanization,
2. prioritizing and scaling up existing agro-processing technologies,
3. strengthening Agriculture Technology Development Centre,
4. promote indigenous technical knowledge in agro-processing
5. enhance food safety through (a) promotion of non-destructive analysis of foods and (b) development of harmonization of food safety standards and sampling protocols.
6. Enhance farm income and livelihoods through diversification and value addition of emerging value chains

Objective 7: To reduce pre- and post-harvest losses:

This objective will be realized through two strategies: These are promotion of uptake of pre- and post- harvest handling and storage technologies and practices, and waste recycling and upscaling technologies such as use of waste for animal feeds processing and biogas production

Objective 8: To promote industrial parks systems for value addition:

This objective will be realized through the following six strategies:

1. Development and implementation of a strategy on industrial clusters,
2. Promotion and development of special economic zones and industrial parks,
3. Enhancing the use of technologies to increase market access for manufactured goods,
4. Promotion and development of land banks
5. Increase market access and eco using biotechnology
6. Enhance the use of biotechnology for agro-processing

3.4.4 Key Result Area 4: Technology Transfer and Commercialization of R&D outputs

The situation analysis showed that some of the challenges of the Kenyan STI ecosystem are: the low level of innovation and use of outdated production systems that has led to low productivity and competitiveness of Kenya's industries; the low level of awareness of the role of intellectual property rights in fostering socio-economic development is hindering the development, commercialization, registration, and protection of new innovations in the manufacturing, and the weak linkages between academia and industry. Kenya needs to improve her competitiveness, productivity, and product quality through adaptation of appropriate technology and certification.

Objective 9: Promote the use of intellectual property rights

This objective will be realized through three strategies. These are: to develop and implement national intellectual property policy; create awareness and capacity building of MSMEs on intellectual property; promote the utilization of expired IP rights as well as patent information system.

Objective 10: Promote technology transfer and commercialization of R&D outputs

This objective will be realized through the following four strategies. These are: develop and implement a strategy for commercialization of innovations and intellectual property rights in universities and research organizations; develop a strategy for strengthen collaboration between universities and research organization; reintroduce the concept of African Knowledge Transfer Partnerships; and promote the development and implementation of IP policies in universities and research organizations

Objective 11: Promote the development of innovation and startups ecosystems

This objective will be realized through the following six strategies:

1. Develop a strategy for enhance the development of innovation and growth startups in agricultural and manufacturing sectors
2. Promote the development of business incubation, technology transfer offices and innovation labs in universities and research organization

3. Develop a guideline for the coordination and management of innovation hubs
4. Support development and uptake of sustainable climate smart agricultural technologies
5. Support development and deployment of ICT based solutions in agro-processing
6. Develop a framework for industry-academia collaboration
7. Finalize the incubation policy

3.4.5 Key Result Area 5: Involvement of youth in agriculture and manufacturing

Due to the STI gaps identified in section 2.6, the low level of innovation and use of outdated production systems has led to low productivity and competitiveness of Kenya's industries. Furthermore, the low level of awareness of the role of intellectual property rights in fostering socio-economic development is hindering the development, commercialization, registration, and protection of new innovations in the manufacturing. The country needs to improve its competitiveness, productivity, and product quality through adaptation of appropriate technology and certification. roadmap will address these challenges by pursuing the following strategies:

1. Develop and implement a strategy to enhance the participation of youth in modern agriculture
2. Develop and implement a strategy to enhance the participation of youth in the blue economy
3. Develop and implement a strategy to enhance the participation of youth in agro-processing and value addition Processing
4. Develop and implement a strategy to enhance the participation of youth in sub-contracting
5. Promote One Village One Product Industrial Strategy.

4. CHAPTER FOUR: IMPLEMENTATION PLAN FOR ROADMAP

The successful implementation of SDGs 2 and 9 hinges upon a robust implementation framework with distinct but complementary roles in agriculture and manufacturing sectors. The plan specifies insitutions, responsibilities, financial resource requirements and accountability mechanisms in each sector. It outlines the selected institutions, mandates and relationships that are tasked with coordinating, planning, implementing and monitoring actions towards the SDGs 2 and 9 to ensure a strong institutional framework.

4.1 Institutional Framework

The overall management and coordination of the implementation, monitoring and reporting of the SDGs process in Kenya is the responsibility of the State Department for Planning through SDGs Coordination Directorate. The Directorate is supported by the Inter-Agency Technical Working Committee (IATWC) that was set up in early 2016. The IATWC is Co-chaired by Kenya Private Sector Alliance and the SDGs Kenya Forum. A sub-committee of the IATWC has been set up to work closely with the SDGs Directorate.

The membership of the IATWC comprises of the Ministries, Departments and Agencies (MDAs), the Council of Governors (COG), Kenya Private Sector Alliance (KEPSA), Kenya Association of Manufacturers (KAM), Parliamentary Caucus on SDGs and Business, SDGs Kenya Forum, United Nations Development Programme (UNDP) and Academia while the composition of the sub-committee include members from the State Department for Planning, COG, KEPSA, KAM, SDGs Kenya Forum, UNDP, Parliamentary Caucus on SDGs and Business, and Academia.

The implementation of the STI Roadmap for SDGs 2 and 9 will require establishment of linkages, collaborations and partnerships for effective coordination, monitoring, evaluation, reporting and learning. The proposed institutional framework for implementation of the STI for SDGs roadmap will comprise of MDAs, implementation agencies and Inter-Agency Coordination Group(s).

4.1.1 Ministries

The implementation of the STI Roadmap for SDGs 2 and 9 will be spearheaded by the Ministry responsvile for agriculture, livestock, fisheries, industry, trade, enterprise development, and education. The ministries will be supported by the National Treasury, State Department for Planning that hosts the SDGs Coordination Directorate and the National Commission for Science, Technology and Innovation.

4.1.2 Implementing Agencies

The Ministries, Government Agencies, Universities, Research Institutions and other institutions will implement projects under the STI for the SDG Roadmap. The departments and agencies under the ministries in the Table 4.1: will be involved in the implementation of the projects.

Table 4.1: Key Implementing Agencies

SN	Ministries	Agencies
1	Agriculture, Livestock and Fisheries	1. Kenya Agricultural and Livestock Research Organization
2	Industry Trade and Enterprise Development	1. Kenya Industrial Research and Development Institute 2. Kenya Industrial Property Institute 3. Kenya Bureau of Standards
3	Education	1. National Commission for Science, Technology and Innovation 2. Kenya National Innovation Agency 3. National Research Fund 4. Universities
4	The National Treasury and Planning	1. SDGs Coordination Directorate/ Secretariat within the State Department of Planning

4.1.3 Inter-Agency Coordination Group

This group will be formed from the implementing agencies. All implementing agencies will have a focal person(s). These persons will form the Inter Agency Coordination Group. The focal persons and other officers so nominated will develop the work plans and the indicators for monitoring the projects that the implementing agencies will be undertaking. The monitoring and evaluation will be done at the implementing agency level. NACOSTI will provide the secretariat for the inter agency coordination group for the STI for SDGs roadmap.

4.2 Communication

Effective communication is critical for successful implementation of the STI for SDGs Roadmap. Upon approval of the roadmap a comprehensive communication strategy will be developed. The communication will cover all aspects of the roadmap and involve wider dissemination across stakeholders.

4.3 Resource Mobilization

Partnerships and collaboration amongst stakeholders is critical for the successful implementation of the SDGs 2 and 9. These will include national, county governments, the development partners, members of legislative assemblies and non-state actors among others. A strong collaboration will ensure creation of synergies that are necessary in implementation of the SDGs.

It is therefore necessary to ensure that the activities and budgets for SDG 2 and 9 are incorporated in the Sustainable Development Goals in National Frameworks. Kenya's long-term development blueprint the Kenya Vision 2030 is implemented through five-year Medium-Term Plans (MTPs). The Fourth MTP 2023 -2027 currently under development. Mainstreaming of SDGs 2 and 9 in the Fourth MTP 2023 -2027 and the subsequent County Integrated Development Plans (CIDPs), 2023 -2027, will position the SDGs to better implement the processes.

4.4 Monitoring, Evaluation, Reporting and learning

Monitoring and evaluation is important during implementation of the SDGs. Assessing progress towards SDGs 2 and 9 will rely on elaborate systems of measurement, covering several sectors and indicators. This involves consolidation of their results into outcomes and map them onto the SDGs –coordinating teams working across multiple sectors. Therefore, there is need to put in place a robust SDGs monitoring and evaluation framework to cover all the activities that contribute to the achievements of the SDGs. This framework should be inclusive and provide for multi stakeholder engagement from local through to national levels. It should also have coordinated interventions to strengthen statistical capacities to collect, collate and analyze data.

A multi-level monitoring and evaluation system will be used for monitoring the SDGs in the country. Tracking and reviews of the SDGs indicators at the national level, monitoring and evaluation of policies, projects and programmes outlined in MTP is done through National Integrated Monitoring and Evaluation System (NIMES) which was established in 2004. It employs a result-based monitoring framework and provides important feedback to policy makers and the general public on the national government's performance. At County level, tracking progress towards the achievement of the policies, projects and programmes outlined in each CIDP will be undertaken through the County Integrated Monitoring and Evaluation System (CIMES).

For effective monitoring of the SDGs, NIMES will be aligned with the SDGs and the second National Indicator handbook for monitoring MTP IV will be expanded to cover all relevant SDGs 2 and 9 indicators. The indicators should be integrated with the National Statistics System (NSS) supervised and coordinated by the Kenya National Bureau of Statistics (KNBS). The integration is achieved by ensuring that the SDGs indicators are incorporated in regular surveys undertaken by KNBS.

5. ANNEXES

Annex 1: Agriculture and Agro-Processing Implementation PlanStrategies (Objectives)

Annex 1: Agriculture and Agro-Processing Implementation PlanStrategies (Objectives)	STI entry point	Key players	Implementing Agency	Estimated Budget (000')	2022/23	2023/24	2024/25	2025/26	2026/27
To enhance access to affordable fertilizer	Increase production capacity of local in-organic, organic (bio) fertilizers and integrated fertility management	MoALFC, KALRO, Private sector, Development partners	MoALFC, KALRO	67,500	13,500	13,500	13,500	13,500	13,500
	Develop and standardize affordable tools for inspecting soils and crops	KALRO (National Agricultural Research Laboratories)	KALRO						
	Develop and promote sustainable agriculture and livestock waste management (agro-ecology)	MoALFC, KALRO, CGIAR Centres,ICIPE, County Goverments, KIRDI,	KALRO						

To enhance application of ICT in agro-processing	Enhance use of digital technologies in integrated agro-processing information system (i.e., Farmer registration; e-messaging; information sharing)	MoALFC [AIRC], MoITED, MoICT, KALRO, KIRDI, County Governments, ICTA	MoITED, AIRC, KIRDI, KALRO, ICTA	1,650	500	1000	50	50	50
Review the Warehouse Receipting System Act 2019 to cover the whole agro-processing value chain MoALFC, MoITED,			MoALFC, MoITED,	7	7				
To improve farm income and livelihoods through diversification and value addition of emerging value chains	Support use of technologies in extraction of active ingredients to develop high value products	KALRO, KIRDI	KALRO, KIRDI						
	Develop and promote diverse varieties of emerging crops (eg., Seaweed, Miraa, Millet, Sorghum, cassava)	KALRO, County Governments	KALRO						
	Support livestock and fisheries Production (hides, skins, milk & meat)	KALRO, Ewaso Nyiro Development Authority, County Governments	KALRO, County Governments (CoG)	920	20	100	200	300	300

	Support livestock and fisheries Value addition (hides, skins, milk & meat)	MoITED, MoEACRD, KIRDI, KALRO, EPZA, KLDC, TPSCI, Ewaso Nyiro Development Authority, CoG	MoITED						
	Enhance use of integrated pest management practices (Bio-pesticides, biological control, Push& Pull technologies)	MoALFC, KALRO, ICIPE,	KALRO						
To support disease and pest control	Adopt and strengthen usage of digital surveillance within counties in identifying pest and disease infestation	MoALFC, MoICT, KALRO, CoG, ICTA, DVS	KALRO, ICTA						
	Use of modern technologies to develop pest, disease and drought resistant plant varieties and livestock breeds (i.e., genome-editing, Use of haploid breeding technology)	MoALFC, KALRO, DVS, Universities, ILRI, African Agriculture Technology Foundation, ISAAA,	KALRO, Universities						
To enhance access to technologies in agro-processing	To Promote digital agricultural mechanization	MoALFC, MoICT, KALRO, ICTA	KALRO						

	Promote and scaling up of existing technologies	MoITED, KIRDI, KALRO, CoG, Jua Kali Association (KNFJKA), MSEA,	MoITED	40,000	10,000	10,000	10,000	10,000	10,000
	Develop a sustainable strategy on the 5KMSE technology support initiative	MoITED, KIRDI, KALRO, CoG, Jua Kali Association (KNFJKA), MSEA, (KIPI, KIRDI, KIE, KEBS, Kenya National Federation of Jua Kali Association, NMC, Academia. KENIA, NRF, NACOSTI, Business Management Organizations (i.e, KAM, KEPSA, Chambers of Commerce and Industry)	MoITED						
	Strengthen Agriculture Technology Development Centers	MoALFC, KALRO, county governments	MoALFC, KALRO						
To promote Climate Smart Agriculture (CSA)	Promote uptake of Sustainable Smart Agricultural technologies (i.e., use of isotopes in terms of water uptake and wheat rust resistance; precision agriculture; Nanotechnology)	CoG, KALRO, Universities	CoG, KALRO, Universities						

To enhance food safety	Promote non-destructive analysis of foods (Contaminant sensing technologies)	MoITED, MoH, KEBS, KIRDI, Private sector, CoG	KEBS, KIRDI, CoG (Public Health)						
	Development and harmonization of food safety standards and sampling protocols	MoITED, KEBS, Private Sector, MoH, CoG,	KEBS, CoG (Public Health)						
	Enhance availability of quality feeds and supplements	MoITED, MoALFC, KALRO, KEBS, Private Sector, Universities, CoG	MoALFC, MoITED, KEBS						
To reduce pre-and post-harvest losses	Promote uptake of pre-and-post-harvest handling and storage technologies and practices	KIRDI, KALRO, KENIA, Private Sector, Universities, CoG, NRF	KALRO, KENIA, KIRDI, NRF						
	Adopt value addition technologies (storage technologies, waste-to-animal feeds, biogas)	KIRDI, KALRO, KENIA, Private Sector, Universities, TVETS, CoG	KALRO, KENIA, KIRDI, NRF, CoG						
To promote commercialization of research outputs	Develop a commercialization strategy to ensure that the identified STI solutions are implemented	KENIA, NRF, NACOSTI, Universities and TVETS, Private Sector	KENIA						
	Develop and/or strengthen incubator and accelerator support programmes	KENIA, NRF, KIRDI, KALRO, Universities and TVETS, Private Sector	KENIA						

	Develop a quadruple-helix framework	MoALCF, MoITED, MoE, KENIA, NRF, KIRDI, KALRO, NACOSTI, Universities and TVETS, Private Sector	NACOSTI						
To enhance agro-processing using Biotechnology	Enhance breeding using genetic resources and research	MoALFC, KALRO, Universities, KEPHIS, ILRI, CGIAR, ICIPE, Kenya Livestock Breeders Association, Kenya Animal Genetic Resource Centre, Boran Cattle Breeders Society of Kenya	KALRO, Kenya Animal Genetic Resource Centre						
	Establish a genetic and Bio-technology Centre of excellence	MoALFC, KALRO, Universities	KALRO, Universities						
	Enhance environmental protection through development and promotion of biopolymers' research and products	MoALFC, KALRO, NEMA, Universities, NMK	KALRO						
	Support genetic resources conservation	MoALFC, KALRO, NMK, Universities, Kenya Forestry Service, KWS,	KALRO, NMK, Kenya Forestry Service, KWS,						

To promote crops/ fisheries/ livestock insurance	Enhance yield and risk prediction modeling	MoALFC, KALRO, Association of Kenya Insurers	MoALFC						
	Strengthen weather forecasting / early warning system (based on integration of localized sensors and satellite technology, including ITK)	MoALFC, Ministry of Environment and Forestry, Kenya Meteorological Department, MoICT	Kenya Meteorological Department						
	Development of affordable insurance schemes	MoALFC, KALRO, Treasury, Insurance Regulatory Authority, Association of Kenya Insurers,	Insurance Regulatory Authority, Association of Kenya Insurers	3,500	1,000	1,000	500	500	500
To promote peri-urban and urban agriculture	Promote vertical farming; hydroponics and aeroponics; aquaponics, re-circulating hydroponics; A-vertical system	MoALFC, KALRO, CoG, NEMA, KIRDI	KIRDI, KALRO, CoG						
	Review of peri-urban and urban agriculture policy	MoALFC, CoG, NACOSTI	MoALFC	60		60			

	Promote rainwater harvesting technologies	Ministry of Water, Sanitation and Irrigation, KEWI, Regional Centre on Ground Water Resources, Education, Training and Research, National Water Harvesting and Storage Authority, Water Works Development Agency	National Water Harvesting and Storage Authority,						
	Develop nutrient solution for urban agriculture crops	MoALCF, Universities, KALRO,	KALRO, Universities						
To increase the participation of the Youth in modern agriculture, Blue economy and Co-operatives	Develop a plan on how to engage the youth more in agriculture and agro- processing through use of modern technology	MoALCF, MoITED, Ministry of ICT, Youth and Innovation, KIRDI, KALRO, NACOSTI, KENIA, Universities and TVETS, Private Sector	MoITED						

	Promote cottage industries using the one village-one product approach	MoITED, KIRDI, KALRO, CoG, Jua Kali Association (KNFJKA), MSEA, KIPI, KIRDI, KIE, KEBS, Numerical Machining Complex, Academia. KENIA, Business Management Organizations [i.e, KAM, KEPSA, Chambers of Commerce	MoITED	1.000,000	350,000	200,000	200,000	150,000	100,000
	Build capacity for exploitation of sustainable blue economy opportunities	MoALCF, MoITED, KIRDI, KALRO, NACOSTI, Universities and TVETS, Private Sector, Kenya Fisheries Service, KEMFRI	Kenya Fisheries Service,						
To promote traditional Knowledge (TK) in agro-processing	Document, adapt and promote TK	MoALCF, MoITED, Ministry of Sports Culture and Heritage, KIRDI, KALRO, NACOSTI, NMK, Private Sector, Universities, CoG	NMK						
	Conserve, improve and commercialize TK	MoITED, MoALCF, KIRDI, KALRO, NMK, KEPHIS, KIPI, Universities, CoG	NMK, KALRO,CoG						

To provide support systems for sustainable development of MSMEs sector through STI	Promote value addition through product diversification and branding	MoITED, MoALCF, KIRDI, KALRO, Kenya Export Promotion and Branding Agency, KIE, KIPI, MSEA, KNFJKA (Jua Kali Association), MSE Association, KEBS	MoITED	50,000	10,000	10,000	10,000	10,000	10,000
	Promote the development of High-Tech Manufacturing practices	MoITED, KIRDI, CoG, Jua Kali Association (KNFJKA), MSEA, KIPI, KIRDI, NMC, Business Management Organizations [i.e. KAM, KEPSA, Chambers of Commerce)	MoITED						
	Promote the adoption of cleaner production technologies	MoITED, Ministry of Forestry and Environment, KIRDI, NEMA, Kenya National Cleaner Production Centre	MoITED	100,000	25,000	20,000	20,000	20,000	15,000

	Develop a sustainable strategy on the 5KMSE technology support initiative (KIPI, KIRDI, KIE, KEBS, Kenya National Federation of Jua Kali Association, NMC, Academia. KENIA, NRF, NACOSTI, Business Management Organizations [i.e, KAM, KEPSA, Chambers of Commerce and Industry])	MoITED, KIRDI, KALRO, CoG, Jua Kali Association (KNFJKA), MSEA, KIPI, KIE, KEBS, NACOSTI, Numerical Machining Complex, Academia. KENIA, Business Management Organizations [i.e, KAM, KEPSA, Chambers of Commerce	MoITED	5,000	5,000				
	Finalize the incubation policy	MoITED, KIRDI, KALRO, CoG, Jua Kali Association (KNFJKA), MSEA, (KIPI, KIRDI, KIE, KEBS, Kenya National Federation of Jua Kali Association, NMC, Academia. KENIA, NRF, NACOSTI, Business Management Organizations [i.e, KAM, KEPSA, Chambers of Commerce	MoITED	2					

To strengthen linkages between MSMEs and large enterprises	Finalize the sub-contracting policy	MoITED, KIRDI, KALRO, CoG, Jua Kali Association (KNFJKA), MSEA, (KIPI, KIRDI, KIE, KEBS, Kenya National Federation of Jua Kali Association, NMC, Academia. KENIA, NRF, NACOSTI, Business Management Organizations [i.e, KAM, KEPSA, Chambers of Commerce	MoITED	2					
	Review and implement the industrial cluster development policy	MoITED, KIRDI, KALRO, CoG, Jua Kali Association (KNFJKA), MSEA, (KIPI, KIRDI, KIE, KEBS, Kenya National Federation of Jua Kali Association, NMC, Academia. KENIA, NRF, NACOSTI, Business Management Organizations [i.e, KAM, KEPSA, Chambers of Commerce	MoITED	2					
To promote and develop special economic zones and industrial parks	Promote and develop land banks	MoITED, Ministry of Lands and Physical Planning, Nation Land Commission, CoGs, Local Communities	MoITED						

	Convert conventional parks into eco-industrial parks (promotion of resource efficient cleaner production, green & circular economy)	MoITED,Ministry of Water, Ministry of Energy, EPZA, SEZA (Special Economic Zones Authority), NEMA,	MoITED						
	Promote Foreign and Direct Investments in manufacturing and related services	MoITED, Kenya Investment Authority (KENInvest), EPZA, SEZA, KEPROBA)	MoITED						
To increase market access for manufactured goods	Promote E-commerce	MoITED, MSEA, KEPROBA, BMOs	MoITED						
	Promote Eco-labeling	MoITED, KIPI,Private Sector, KEPROBA	MoITED						
	Improve product quality and standards (ISO, GEMBA-KAIZEN 5S philosophy)	MoITED, Ministry of Labour and Social Protection (National Productivity and Competitiveness Centre), KIPI, KEBS, MSEA, Kenya National Federation of Jua Kali Association, MSE Association,	MoITED						

To promote intellectual property rights	Create awareness and capacity building of MSMEs on intellectual property	MoITED, KIPI, KIRDI, NACOSTI, MSEA, KENIA, Universities, Kenya National Federation of Jua Kali Association, CoG	MoITED						
	Promote utilization of IP in public domain	MoITED, KIPI, KIRDI, NACOSTI, MSEA, KENIA, Universities, Kenya National Federation of Jua Kali Association, CoG	MoITED						
To revitalize and modernize strategic industries	Adopt and domesticate environmentally sound technologies	MoITED, KIRDI, NMC, MSEA, KENIA, Universities, Kenya National Federation of Jua Kali Association, CoG	MoITED						
	Promote integrated value chains (i.e., textile)	MoITED,Ministry of Water, Ministry of Energy, EPZA, SEZA (Special Economic Zones Authority), NEMA,	MoITED						
To strengthen industry-academia collaboration	Develop a framework for industry-academia collaboration	NACOSTI, KENIA, LIWA, Universities, TVETS, R&D institutions, MoE, Private sector	NACOSTI						

To enhance access to affordable financing	Implement credit guarantee scheme	Ministry of Finance and Planning; MoITED,	Ministry of Finance and Planning						
	Improve access to Climate Fund	Ministry of Finance and Planning; MoITED, Ministry of Environment, Commercial Banks,Climate Change Directorate, Climate Change Unit (Ministry of Finance)	Climate Change Directorate, Climate Change Unit (Ministry of Finance and Planning)						
	Operationalize the MSE Fund	Ministry of Finance and Planning; MoITED, MSEA,	Ministry of Finance and Planning						
In the definition of terms, note that, agro-processing includes leather and the textile (non-food) value chains									

Annex 2: Mapping gaps and STI entry points for SDG 2 and SDG 9

Sectors	Target	Gaps	STI Entry point
Agriculture (KIRDI and MoA)	2.1. To end hunger and ensure access by all people to safe, nutritious, and sufficient food all year round	• Limited STI infrastructure and support systems • Inadequate resources and capacity (financing)	Establish the infrastructure and knowledge sharing framework
Agriculture	2.2. To end all forms of malnutrition for all the marginalized population.	• Imbalance in the consideration of food security and limited focus on food quality	• Improved innovations including bio-fortification, new varieties and breeding • Process innovation • Making products accessible to people, affordability, ownership and inclusivity • Market innovations-new business models • Digitization of value chains • Leveraging STI to strengthen commodity value chains • Supporting smallholder farmers to be innovators and entrepreneurs
Agriculture	2.3. To double the agricultural productivity and incomes of small-scale food producers.	• Limited access to inputs • Low quality breeds and varieties • Limited access to technologies • Overdependence on rainfed agriculture • Small farm sizes • Pest and diseases • Minimal farm mechanization (inappropriate technologies and innovation) Low empowerment of women and youth • Limited availability of data • Limited use of digital agriculture • Weak/inadequate extension services • Limited product diversification • High postharvest losses	
	2.4. To ensure sustainable food production systems.	• Limited agroforestry • Limited intensification	• Circular innovations • Improved bio product innovation

	2.5. By 2030, to maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed.	• Inadequate infrastructure and land for conservation in-situ and ex-situ at the genebank. • Inadequate finances (e.g for databases) • Inadequate human resources • Lack of agricultural ITK platform for crop and livestock germplasm • Limited enforcement of biopiracy and IP laws • Inadequate awareness and capacity on conservation and materia/information transfer agreements (MITAs) and protocols	• Capacity building on conservation and enforcement of various biopiracy laws. • Investment in acquisition/ development of modern equipment for conservation • Molecular profiling of indigenous crop and livestock germplasm • Creation of databases through digitization of crop and livestock germplasm.
	2a. To increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries	• Inadequate infrastructure for agricultural R&D across the country. • Inadequate agro-processing facilities in every county (i.e., one village, one product) • Lack of a partnerships framework to enable different R&D and extension institutions to work together.	• Moderdine STI infrastructure across the Counties • Develop, validate, package and upscale technologies/ innovations for agro-processing for different regions • Strengthen partnerships among R&D institutions and extension • Revamp extension information databases
	2c. To adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility.	• Inadequate access to market information • Limited processing/ value addition of agricultural products • Most agricultural products are sold in the domestic/ international markets in raw form	• Develop and use ICT apps to provide update market information on timely basis for different products • Strengthen price trends monitoring and sharing system • Invest in value addition technologies and cottage industries in the rural areas.

Manufacturing	9.2: Promote inclusive and sustainable industrialization	• Limited implementation of policies that promote commodity-based industrialization that is not sustainable • Limited adoption of green manufacturing practices	• Ensure adequate resourcing and incorporation of the ideals of sustainability in value chains. • Review the Green Economy Strategy and Implementation Plan (GESIP-2016-2030) to incorporate green manufacturing practices and embrace inclusivity • Develop green manufacturing strategies drawing from the GESIP
	9.3: Increase access to financial services and markets	• Limited access to finances • Encourage product innovation along the sectoral value chains and markets • Collateral- Limitations • Lack of green credit lines (financial products)	• Raise awareness on available financial mechanism including FinTechs, Credit guarantee scheme; Promote social innovations- organized groups accessing credit through self-guarantees. • Create credit lines to support green solutions • Accelerate access to green bonds (KCB) • Organize Trade Fairs Exhibitions and Tours; Promote e-commerce for market accessibility
	9.4: Upgrade all industries and infrastructures for sustainability	• Obsolete technologies • Inadequate supporting infrastructure	• Adopt modern technologies and support technology transfer • Development of STI infrastructure sharing framework; Establishing industrial zones • Strengthen governance structure • Develop and strengthen incubation and accelerator support programmes

	9.5: Enhance research and upgrade industrial technologies	• A mismatch between skills and knowledge developed at teaching and learning institutions and the needs of the industry • Few researchers in the private sector • Limited funding • Limited technology transfer and IP utilization and commercialization • Limited access software e.g. process optimization, design and modeling	• Establishment and constant review of prioritized research themes • Mainstream innovation studies at local Universities; Use the quadruple helix to enhance linkages between key stakeholders (R&D, academia, Govt, Industry. CBOs and users); Strengthen institutions; Create incentives for the private sector to promote research. • Promote technology transfer and commercialization • Resource mobilization (Govt and private sector)

Annex 3: Manufacturing Output, Compensation of Employees and Value Added at Current Prices, 2016-2020

Year	Value of Output	Intermediate Consumptions	Value Added	Compensation of Employment
2016	2,003,566	1,295.686	707,880	172,208
2017	2,109,602	1,368,227	741,376	190,339
2018	2,216,547	1,431,178	785,369	206,420
2019	2,309,175	1,501,360	807,814	218,349
2020*	2,374,234	1,555,880	818,353	215,564
2021				
2022				

Annex 4: Other policies, strategies and legislations - Policies aligning to SDG targets (provides a list of additional policies, strategies and legislations that support the manufacturing sector).

Policies and Strategies	Legislations
1. The Kenya Vision 2030 and successive Medium Term Plans (MTPs) 2. National Trade Policy, 3. Investment Policy 4. Buy Kenya Build Kenya (BKBK) strategy 5. Draft National Automotive Policy - February 2019; is it still draft? 6. National Cooperative Development Policy 7. The National Industrialization Policy 8. MSE policy 9. Draft Kenya Leather Development policy; is it still draft? 10. National Research Priorities	1. Anti-Counterfeit Regulations, 2010 2. Competition Act No. 12 of 2010 3. East African Community (EAC) Competition Regulations, 2010 4. East African Community EAC Competition Act 2006[F1] 5. Investment Promotion Act 2004 6. Micro and Small Enterprises Act, 2012 7. Partnership Act No.16 of 2012 8. Scrap Metal Act, 2015 9. Special Economic Zones Act 2015 10. Standards Tribunal Practice and Procedure Rules 2012 11. The Anti-Counterfeit Act 2008 12. The Companies Act Cap 486 13. The Export Processing Zones Authority (EPZA) Act 14. The Industrial Property Act, 2001 15. Understanding of East African Community Legislation on Standardization, Quality Assurance, Metrology and Testing Act (SQMT)