NATIONAL RESEARCH STRATEGY

September 2021
Ministry of science and higher education

NATIONAL RESEARCH STRATEGY

Ministry of Science and Higher Education

September 2021
First Edition

Contents

MESSAGE FROM THE MINISTER

The Ministry of Science and Higher Education (MoSHE), established by Proclamation 1097/2018, is responsible to lead higher education, and technical and vocational education and training (TVET) institutions in Ethiopia. Moreover, MoSHE is mandated to coordinate Science and Institutional linkages at national level. One of the main tasks of MoSHE's science coordination is to make sure research undertakings are aligned with the national development agenda and address societal and economic demands via focusing on selected development priority areas.

The government of Ethiopia has recently identified five major development priority areas, namely, agriculture, manufacturing, tourism, ICT and Mining. These development priorities are expected to be achieved through various policy interventions, as well as through research and development approaches.

Research plays key role in improving the well-being of society, and ultimately brings economic development. MoSHE, in line with its science coordination mandate has therefore developed this national research strategy which directs all research undertaking in the country be aligned with these development priority sectors. This national research strategy has also included three cross-cutting sectors, namely education, health, and Peace & diplomacy. This national research strategy will therefore be a vital policy document that enable sectoral research activities to be in accordance with the national development priority areas. Moreover, the national research strategy will improve knowledge management, research governance, research financing and incentive schemes. The strategy will also help to strengthen human capacity development, research infrastructure and facility, as well as enhance partnerships among reginal, continental, and international organizations.

Therefore, the Ministry of Science and Higher Education (MoSHE) has taken the lead in developing this national research strategy, which is the first in kind in the country. I am confident that the national research strategy will help a lot in addressing the national development goals.

I would like to thank all contributors who provided their rich technical expertise and play a key role in compiling this national research strategy document.

H.E. Samuel Urkato (PhD)
Minster, Ministry of Science and Higher Education

MESSAGE FROM THE STATE MINISTR

Ethiopia aspires to become a prosperous county. In this regard, the ten year perspective plan of the country recognizes the critical roles to be played by research in accelerating economic development. It also demands the need to intensify the application of research findings to raise productivity and efficiency levels across its economic, social and political pillars. Cognizant of these, the Ministry of Science and Higher Education, in line with the science coordination mandates given by Proclamation Number 1097/2018, initiated and led the development of the first national research strategy.

The national research strategy aims to provide the general framework that will allow for a targeted development of Ethiopia's research ecosystem in the years to come. The strategy is a result of national teamwork and an outcome of consultations and workshops with ministries, research institutes, universities, researchers, academics, employers, NGOs, and government agencies. In its preparation, a broad analysis of the Ethiopian research system was performed focusing on strengths, weaknesses, opportunities and threats. National priorities and socio-economic contexts aimed to ultimately transform the country to knowledge-driven economy and to develop knowledge society through effective use of research results were taken into account.

As the generation of new knowledge through scientific research underpins the realization of Ethiopia's holistic development agenda, national research priority areas have been defined for Agriculture, Manufacturing, Mining, Tourism, Digital Technology, Education, Health, and Governance, Human Security and Regional Integration, all of which are pillars of the country's ten year perspective plan. Both the strategy and the priority areas are believed to pave ways for improving quality and relevance of the vital sectors and hence to contribute to the overall development of the country. Therefore, we call upon government ministries, departments and agencies, universities, research institutions, technical and vocational education and training institutions, industries, development partners and the private sector to initiate strategic collaborations to realize strengthened research system, research infrastructure, research centers, research facilities, research human resource, research findings dissemination, etc. in Ethiopia so that research can contribute better in Ethiopia's move towards a knowledge-driven economy.

Finally, we would like to express our thanks to all who have contributed to the development of the national research strategy and priority areas.

H.E. Professor Afework Kassu Gizaw
State Minister, Ministry of Science and Higher Educaion
September 2021

1. Introduction

Ethiopia aspires to join the rank of a middle-income country by 2030. It is understood that sustainable socio-economic development and transforming the country can be hastened by knowledge generation for evidence based policy making and implementation. This can be achieved through quality, relevant, innovative and problem-solving research. Therefore, the country should engage in a globally competitive research environment by enhancing its research capacity.

In Ethiopia, research has been conducted on various disciplines in different institutions for the last decades. However, the contribution of the research outputs to the national economy and societal wellbeing is below the expected level. A consensus study by the Ethiopian Academy of Sciences (EAS) showed that research activities are inadequately funded and not properly integrated into the national socio-economic development issues. Further, researches lack multidisciplinary perspective to solve the complex socio-economic and political problems of the country. This is because the structure and arrangement of research themeatic areas lack integrated approach and are disintegrated into more of desciplines that do not give chance for systems approach. Research undertakings in Ethiopia are also characterized by lack of strong research institutions, lack of proper research mangament sytem, lack of reward for esearchers including lower salaries. These limitations partly emanate from lack of coherent national research policy and strategy.

Therefore, research undertakings at the national level need to be prioritized, thematized, properly financed, integrated and streamlined to feed into the development endeavours. This requires adequate public investment, capacity development, private sector involvement, national and international collaboration and appropriate policy framework.

This strategic document, thus, aims at providing the guiding framework to initiate, direct and implement nationally relevant and socio-economically significant research endeavours. The document contains the overall policy framework and directions along with major research strategic goals, objectives, core activities and key performance indicators (KPIs). The document is developed through a series of consultative meetings by engaging different stakeholders from government, academia, research institutes, industry and the private sector. National policies and strategies including the National Development Plan (2021-2030), Higher Education Policy and Strategy, National Science, Technology and Innovation Policy, National Science Policy and Strategy and Consensus Study on National Research Council of Ethiopia were used in the development of this strategy.

2. Rationale of the Strategy

Research plays key role in improving the well-being of society. As Ethiopia aspires towards knowledge driven economy, the limited resources available to support priority developmental

economic sectors and enabler sectors require setting research priorities and their effective and efficient management. The limited resources available for research require setting research priorities that will solve the pressing problems of the country. Since setting priorities is ultimately about resources allocation, it often becomes highly contentious. Apart from this, the limited resource requires strategic leadership and setting priorities to have the desired outcomes in the areas of research.

To develop the National Research Strategy, it is prudent to set the vision and mission, analyze strengths and weaknesses, opportunities and threats, strategic pillars and the key performance indicators which guide the overall research activities in the universities, research institutes and other institutions. Such efforts will increase the likelihood that the research findings will be used to enhance economic growth through solving critical development challenges. The strategy will help to promote dialogues among researchers, research funding organizations, policy-makers and implementers. It will help to minimize duplication of research efforts and to prevent wastage of resources. These in turm will contribute to the achievements of the National Development Plan.

The strategy will also help to identify core activities of critical areas under the main strategic pillars such as human capacity development, research infrastructure and facility, to enhance collaboration, partnership and networking between the national and international organizations, to promote quality and relevant research output in line with national and international development need/agenda, to improve knowledge management, research governance and organization, and to designe research financing and incentive schemes. Focusing on these areas will ultimately improve the research process and enable the nation to develop a knowledge based economy.

In general the strategy has the following rationale:

1. Integrate research undertakings in the country with the national polices, strategies and development needs;
2. Identify issues that improve the quality and relevance of research undertakings in the country;
3. Strengthen synergy among researchers, research funding organizations, policy-makers and implementers;
4. Create supportive environment for research in the country;
5. Improve demand and access for scientific knowledge and research outputs;
6. Reduce duplication of efforts and unwise use of resources for research.

3. Objectives of the strategy

The overarching objective of this strategy is to improve the quality and relevance of research undertakings in the country so that research contributes for the development of the country.
The strategy addresses the following specific issues:

- To improve human and material capacity for research undertakings in the country;
- To strengthen partnerships and collaborations among public and the private sector in the country and beyond;
- To encourage quality, relevant, and multi-disciplinary researches in line with the current and future national development needs of the country;
- To strengthen knowledge management system;
- To establish research effective governance and management system for research projects; and
- To ensure merit-based mechanisims to finance and motivate research.

4. Mission, Vision and Core Values

Mission

The mision of this strategy is to enhance enabling environment for quality scientific knowledge generation and use in support of prospective Ethiopia's development.

Vision

The vision of this strategy is to build knowledge capital and excellence that will accelerate Ethiopia towards prosperity by 2030.

Core values

The core values of this strategy are:

- Professionalism
- High ethical standard
- Inclusiveness
- Knowledge sharing
- Transparency
- Accountability
- Impact driven
- Integrity
- Passion for excellence
- Equity
- Networking and collaboration

5. Strength, Weakness, Opportunities and Threat Analysis of Research in Ethiopia

The following table describes strength, weakness, opportunities and threats (SWOT) analysis of research in Ethiopia.

	STRENGTHS	**WEAKNESSES**
INTERNAL ENVIRONMENT	• Strong government interest to support research endevours • Government interest to use research outputs • Increasing number of higher education institutions (HEI) and research institutes • Increasing trend of qualified manpower in HEI and research institutes • Availability of modest and advanced research equipment and facilities • Research collaborations with various international organizations • An increasing number of national research journals • Encouraging national research, innovation, and technology transfer policy & strategy • Availability of rich and divers natural resources for research & innovation	• Inadequate government funding for research • Limited qualified human capacity for research • Insufficient research infrastructure, facilities and resources • Poor research governance and administration • Lack of demand or social appreciation for research • Low incentives for researchers • Weak research networking • Low capacity for maintenance of research equipment • Bureaucratic hurdles in the procurement of research inputs (equipment & consumables) • Unwillingness to share and hoarding of research equipment • Very low salary & lack of staff retention strategy • Weak research Knowledge management system

		• Lack of incentives & reward system for outstanding researchers • Poor Intellectual Property Right (IPR) management system
EXTERNAL ENVIRONMENT	**OPPORTUNITIES**	**THREATS**
	• Diverse agroecology • Rich diversity of crop and livestock resources • High potential of mineral resources • Rich tourism resource and diverse culture • Expansion of industry parks • Increasing trend of investment • Attractive industrialization and investment policies • Global digital environment • Willing of the Diaspora to participate and assist research in Ethiopia	• Weak economy and shortage of hard currency to buy some of the research facilities • Lack of local/domestic manufacturing to produce research equipment • Climate change • Emerging diseases • Unpredictable international market • Conflict for resources • High turnover of experienced research staff • Weak attitude towards the use of research outputs (considering research as a luxury)

6. Key Strategic Issues

From the SWOT analysis, the following key strategic issues which impend robust, effective and effecient national level research activities and results have been identified.

- Lack of qualified human capacity for research
- Poor research infurastructure and facility
- Poor culture of research collaboration between public-private; public-public institutions and researchers
- Lack of comperhensive and integrated national research agenda
- Lack of knowledge managment system
- Inadequate research finanacing and incentive system
- Poor research governance system

7. Strategic Goals

To address the identified strategic issues the followng strategic goals are required.

1. Develop human capacity for research
2. Improve research infrastructure and facility
3. Strengthen collaboration, partnership and networking
4. Encourage quality, relevant and multidisciplinary research
5. Create knowledge management system
6. Strengthen research governance and organization
7. Improve research financing and incentive sytems

7.1. Develop human capacity for research

Human capacity development is one of the critical needs of Ethiopia where limited human capacity hampered the number, quality and relevance of research undertakings. This strategic goal encompasses nurturing professional competence and scientific culture, among students, researchers and technical assistants to enhance research capacity in higher education and research institutions. This strategic goal is important for human resource development in research and technological innovation. It supports the national vision of making Ethiopia an African Beacon of prosperity. The following key activities are identified for human capacity development for research.

- Enhance the capacity of science and technology institutions that focus on producing well qualified researchers for the economy.
- Increase the number of researchers through provision of targeted training at national and international institutes.
- Increase the proportion of female researchers in universities and research institutes.
- Ensure equity of researchers in research projects (involve researchers with special needs).
- Design and implement human resource retention mechanism.
- Strengthen the skills of support staff and develop strong local R&D management skills.
- Promote and enhance model science and technology schools for gifted and promising students at national and regional levels.
- Launch various clubs, science fairs, exhibitions, and motivational mechanisms for the youth and children to instill a passion for STEM.
- Create, expand and strengthen quality masters and PhD programs that are in line with the government plan through nurturing professional competence, scientific culture, and academic excellence.
- Produce and retain qualified research assistants and technicians.

- Identifying and nurturing young talent at both high school and undergraduate levels and enroll them.
- Providing public universities and research institutions with technical advice, review and recommendations on research infrastructure.
- Make science familiar to the society through different media to create scientific attitude and practice in solving everyday challenges.
- Develop competence of the staff on using research facilities for both teaching and research efficiently.
- Recruit research staff who invest much of their time on research.
- Support professional associations to engage in research undertakings.

7.2. Improve research infrastructures and facilities

Physical resources like equipment, facilities, and inputs/consumables are required by all research institutes to generate technologies, knowledge, and information relevant to socio-economic needs across the country. Though these vary by location and research subject, the physical resources needed in research primarily comprise offices, laboratories, workshops, lab equipment, chemicals and biological reagents, science and technology parks (STPs), ICT infrastructure, residential houses, research stations, stores/warehouses, vehicles and irrigation facilities, among others.

Compared to those of other countries, the research system of Ethiopia is significantly under-resourced in terms of basic equipment, facilities, and inputs. Ethiopian research institutes struggle with old and insufficient vehicles, farm machinery and lab equipment that significantly reduce performance. They also lack an efficient system for managing, maintaining, and replacing the facilities and equipment. Thus, to enhance research infrastructure and facilities, the following key activities are identified.

- Assess the state of research equipment and facilities at the national level.
- Set infrastructure and facility requirements for R&D in universities and research institutions.
- Establish a national database (directory) for research laboratories/workshops including their functions.
- Establish a national/central maintainance system for research laboratory/workshop equipment and facilities.
- Establish a special procurement modality of fulfilling lacking equipment and facilities.
- Promote and work towards enhancing local/domestic manufacturing to minimize dependency on imported research equipments and supplies.
- Standardize and accredit research laboratories and workshops.
- Establish modalities for the utilization of common facility through regional clustering, mobilization and establishing centers of excellence.

- Establish system for the management of research infrastructures & facilities.

7.3. Strengthen collaboration, partnership and networking

Enhanced collaboration, partnership and networking with national stakeholders and international institutions and development partners on mutual understanding and equitable benefit sharing is crucial. The collaboration, partnership and networking of national research strategy shall focus on the area of information sourcing, manpower training, expert assistance, scientific visits, collaborative research, funding scientific projects, and building national research infrastructure capabilities. Therefore, building productive partnerships and cooperation should focus on results, transparency, mutual accountability and agreement on common goals. The following key activities are identified to enhance collaboration, partnership and networking between national and international organizations.

- Establish strong collaboration and networking with national public and private stakeholders (RIs, HEIs, TVETs, industries, national mega projects, etc.).
- Establish strong collaboration and networking with development partners.
- Establish strong collaboration and networking with international research centres.
- Initiate joint collaborative research programs that have national research priority agenda and that will contribute towards the national development program.
- Establish active engagement with embassies and diaspora communities to facilitate bilateral and multilateral agreements for local capacity building elements (training, experience sharing, laboratory twining, etc).
- Encourage researchers to engage in joint research projects that impact social, economic and political contexts.
- Establish/strengthen joint research coordination units in universities, research institutions and industry.
- Facilitate national research review system for newly designed, ongoing and completed joint collaborative research projects.
- Prepare guideline for collaboration, partnership and networking on research.
- Establish a national collaboration and coordination mechanism for sharing equipments and facilities for research.
- Establish centeral/national research and reference laboratories at HEIs and research institutes where advanced equipemnts are availed and shared.

7.4. Encourage quality, relevant, and multidisciplinary researches

Research undertakings in Ethiopia lack quality and relevance in response to national and international needs. The demand for research outputs by industries and policymakers has been

very low and some times considered as a luxury by the public too. This conception emanates partly from lack of awareness about the benefits of research, low level of scientific culture in society, and quality and relevance related problems in research outputs. To address the problem, research quality enhancement mechanisms through updating research priorities, enhancing technology transfer to the end-users, ensuring economic return from research and encouraging thematic and multi-disciplinary research approaches are mandatory. The following key activities are identified to promote quality and relevant research output in line with national and international development needs/agendas.

- Establish and/or revise national research quality enhancement mechanisms.
- Ensure appropriate research accreditation system.
- Promote indigenous knowledge and research.
- Conduct problem-solving and demand-driven research.
- Update national research priority areas and conduct research activities accordingly.
- Increase the country's ranking on the international research indexes.
- Enhance technology transfer to the end-users (industries and communities).
- Ensure economic return from research.
- Enhance thematic and multi-disciplinary approaches in research.

7.5. Create knowledge management system

Knowledge is an important resource for the development of a nation and it should be managed wisely and judiciously. Knowledge management on the other hand is a process that deals with the development, storage, retrieval, and dissemination of information and expertise within an organization to support and improve its performance. Harnessing knowledge enhances innovation and development, and helps to ensure sustainable development and to stay competitive. It requires a major shift in thinking/culture and commitment at all levels including data generators and users. Effective knowledge management and a supportive organizational environment can ideally bring organizational learning and knowledge that can be useful anywhere. The following key activities are identified to create a sustainable knowledge management system.

- Create awareness about knowledge management among all stakeholders.
- Solicit knowledge generators/data sources at the institutional and national level.
- Establish national research data standards.
- Establish a national data repository systems and platforms which can store and share different types of data based on disciplines including biodata.
- Create mechanisms that enhance information exchange among national, regional, continental, and international scientific agencies.
- Share perspectives, ideas, experiences, information, study findings and make them available in the right place at the right time to enable informed decisions.
- Promote utilization of indigenous resources and traditional knowledge.

- Evaluate and update the extensive indigenous resources and traditional knowledge.
- Automate data management system at institutional and national levels.
- Store and utilize information to make sound and informed policies decisions.

7.6. Strengthen research governance and organization

Research governance includes knowledge of the standards, requirements and professional research ethics required for the effective management of research projects. This strategic goal deals with research ethics, intellectual property right and proper research project management including monitoring and evaluating the projects. The following key activities are identified for research governance and organization.

- Develop an/or revise system for research ethics and conducts.
- Develop the competence and skills of researchers and students.
- Establish an institutional system for ethical clearance and conduct of researches accordingly.
- Develop a set of guidelines and checklists to ensure the efficiency and effectiveness of research projects.
- Develop organizational processes for effective management of research projects.
- Design and implement appropriate dissemination systems for research outputs into communities and industries.
- Ensure proper M&E system for research projects.
- Revise current IP policy and establish institutional IP office.
- Address intellectual property right and copyright of researchers and graduate students.
- Establish and strengthen research grant and consultancy offices.

7.7. Improve research financing and incentive systems

Though the amount of research funds hasve been increasing from time to time, still the total amount allocated for research is inadequate in Ethiopia compared with other African countries. Thus appropriate budget has to be allocated for research projects in universities and research institutions. Furthermore, the incentive system for researchers has been very poor in the country. There is a need for an institutional and national system to recognize outstanding researchers and institutions. The following key activities are identified for research financing and incentive schemes.

- Establish National Research Fund and National Research Foundation.
- Ensure equity and diversity in the incentive and reward schemes.
- Provide adequate, performance-based and competitive government funding for research.

- Encourage the industry to participate in financing research.
- Allocate funds to establish research-based enterprises.
- Allocate financial resources to transfer proven research outputs to industries.
- Allocate funds from the internal revenue of the institute for research.
- Establish a national award and recognition system for outstanding achievements.
- Develop a competitive granting system and funding mechanism.
- Establish a private sector research financing system.
- Develop enabling procurement system for research.
- Establish tax exemptions mechanisms for industries involved in research.
- Ensure the availability of supporting institutions for technology transfer and incubating innovation.
- Create mechanisms to use IPs as intangible properties in financing enterprises.

8. Implementation Strategies

The following will be put in place and followed in order to implement the national research strategy.

8.1. Institutionalizing the strategy

All universities and research institutions will develop their own strategies in line with this strategy. By doing so the specific strategies will be cascaded into the universities and research institutions strategic and annual plans.

8.2. Stakeholders engagement

Ministry of science and higher education will strengthen national and sectoral research councils, will organize platforms to support the councils, and will follow-up implementation of the strategy. Professional assocaitaions will also be involved in the platforms.

8.3. Monitoring & Evaluation system

There will be periodic Monitoring & Evaluation of the strategy at institutional and national level based on the KPIs identified. Detailed KPIs for the strategy are presented as annex.

9. Prioritized Research Thematic Areas

Prioritized research thematics areas for the five priority sectors of Ethiopia's 10 year development plan (1. Agriculture, 2. Manufacturing, 3. Mining, 4. Tourism, and 5. Digital Technology) and for the enabler sectors (6. Education, 7. Health, and 8. Governance, Human

Security and Regional Integration) are outlined below. Details of the major thematic areas for the 8 sectors are presented in a separate document.

9.1. Agriculture

Agriculture research thematic areas include:

- Livestock production and health
- Crop production and management
- Agricultural mechanization
- Irrigation water management
- Forest resources and wildlife management
- Soil, water, and watershed management
- Environment and climate change
- Socioeconomics, extension and agribusiness
- Cross-cutting issues

9.2. Manufacturing

Research priority in manufacturing sector include the following;

- Manufacturing inputs (substitution and sustainability)
- Product/process/technology development
- Manufacturing productivity
- Marketing and sustainability
- Manufacturing sector policies, strategies, and management
- Technology transfer

9.3. Mining

Major research priorities are in mining include:

- Applied and innovative geoscience research
- Earth resource exploration
- Earth resources extraction and processing
- Artisanal and small-scale mining
- Geo-hazard risk management and mitigation
- Mining impact and management
- Mining governance

9.4. Tourism

Tourism research priority areas include:

- Tourism resources
- Tourism development and management;
- Tourism and hospitality marketing
- Tourism governance
- Industry practitioners and tourist experiences
- Sustainability of tourism and hospitality
- Culture and development
- Cross-cutting and emerging tourism issues

9.5. Digital Technology

The major thematic areas encompass:

- Artificial intelligence for social good
- Telecommunications
- IT Infrastructure
- Digital economy
- Digital inclusion
- Cyber security
- Emerging technologies

9.6. Education

The following are research priority areas for education:

- Curriculum
- Teaching, learning and assessment
- Access and equity
- Quality, relevance and efficiency
- Governance, leadership and management
- Technology, innovation, adaptation and transfer
- Education for unity in diversity
- Academia-industry linkage and community engagement
- Employability and entrepreneurship

9.7. Health

Research thematic areas for health include:

- Nutrition, food safety and policy
- Environmental and occupational health
- Infectious diseases, global health, drug resistance and genomics
- Non-communicable disease, mental health and rehabilitative health services
- Reproductive, sexual, maternal, new born and child health
- Pharmaceutical sciences and molecular biology
- Health care delivery and policy
- Sport, health and exercise

9.8. Governance, Human Security and Regional Integration

. The major thematic areas for governance, human security and regional integration are:

- Peace and security
- International relation and diplomacy
- Global issues/trends and Ethiopia's International Relations
- Regional cooperation and development
- Cross-cutting issues

10. References

MoSHE 2020. National science Policy & Strategy, Addis Ababa Ethiopia
MoSHE. Higher Education Plicy and Strategy. Addis Ababa Ethiopia
MoSHE. 2019. Directive on Research, Technology Transfer,University-Industry Linkage and community services for higher education Addis Ababa Ethiopia
FDRE. 2011. Science, Technology and innovation Policy, Addis Ababa Ethiopia
National Academy of Sciences. 2015. Consensus Study on National Research Council of Ethiopia: Establishment and operational modalities. March 2015 Addis Ababa
FDRE, Minstry of Science and Technology. 2014. National Research Ethics Review Guideline
Gupta, B., Iyer, L. S., & Aronson, J. E. (2000). Knowledge management: practices and challenges. *Industrial management & data systems*.

11. Annex 1: Key Performance Indicators for the Strategic Goals

11.1. Develop human capacity for research

S.N	Strategies	KPIs

1	Enhance the capacity of universities and research institutes that focus on producing the finest researchers for the economy.	• The number of Ph.D. holders trained in various disciples, • Number of capacitated institutions
2	Increase the number of researchers through the provision of training at national and international institutes	• Number of well-trained researchers at national and international institutes
3	Increase the proportion of female researchers in universities and research institutes	• increased proportion of female researchers in universities and research institutes
4	Design and implement human resource retention mechanism	• Number and varieties of human resource retention packages implemented.
5	Strengthen the skills of support staff and develop strong local R&D management skills	• Number of well-trained research support staff; • Number of pieces of training delivered to R&D management staff
6	Promote and enhance model science and technology schools for gifted and promising students at national and regional levels.	• Increased number of model schools in science and engineering
7	Launch various clubs, science fairs, exhibitions, and motivational mechanisms for the youth and children to instill a passion for STEM.	• Number of schools, universities and research institutes launched various clubs, science fairs, exhibitions, and motivational mechanisms for the youth and children
8	Expand and strengthen graduate programs in line with the government plan through nurturing professional competence, scientific culture, and academic excellence.	• Increased number of MSc and Ph.D. programs • Increased number of young and prospective researchers
9	Produce and retain qualified research assistants and technicians	• Increased number of qualified research assistants and technicians
10	Identifying and nurturing young talent at both high school and undergraduate levels and enroll them,	• Increased number of young and talented students enrolled at both high school and undergraduate levels

11	Providing public universities and research institutions with technical advice, review and recommendations on research infrastructure	• Increased number of technical advice, review and recommendations provided to public universities and research institutions
12	Make science familiar to the society through different media to create scientific attitude and practice in solving everyday challenges.	• Number of challenges of the society solved based on scientific knowledge

11.2. Improve research infrastructures and facilities

S.N	Strategies	KPIs
1	Assess the state of research equipment and facilities at the national level	• Number of assessed universities and research institutes
2	Set infrastructure and facility requirements for R&D in universities and research institutions	• Number of research infrastructure requirements set for universities and research institutes
3	Establish a national database (directory) for research laboratories/workshops including their functions	• Established databases at a national level
4	Establish a national/central Maintainance system for laboratory equipment and facilities	• Established central Maintainance system for laboratory equipment and facilities
5	Establish a modality of fulfilling lacking equipment and facilities (special procurement)	• A modality established to meet missing equipment and facilities
6	Standardize and accredit lab/workshop	• Number of accredited research laboratories
7	Establish modalities for the utilization of common facility through regional clustering, mobilization and establishing centers of excellence	• Number of established regional clusters (north, south, east, west, central)

11.3. Enhance collaboration, partnership and networking

S.N	Strategies	KPIs
1.	Establish strong collaboration, networking with national public and private stakeholders (RIs, HEIs, TVETs, industries, etc..)	• Number of collaborations/ networks established between public and private stakeholders

2.	Establish strong collaboration, networking with development partners	• Number of collaborations/ networks established with development partners
3.	Initiate joint collaborative research programs that have national research priority agenda and direct contribution towards the national development program;	• Number of joint collaborative research programs initiated
4.	Establish active engagement with embassies and diaspora communities to facilitate bilateral and multilateral agreements for local capacity building elements (training, experience sharing, laboratory twining, etc)	• Number of active engagement with embassies and diaspora established communities to facilitate bilateral and multilateral agreements for local capacity building elements
5.	Encourage researchers to engage in joint research projects that can impact social, economic, political and social contexts.	• Number of researchers encouraged in joint research projects
6.	Establish/strengthen joint research coordination work units in Universities and research institutions	• Number of joint research coordination working units established in Universities and research institutions
7.	Facilitate national research review system /platform to review newly designed, ongoing and complete joint collaborative research projects	• Number of research review platforms conducted
8.	Prepare collaboration, partnership & networking research guideline	• A Guideline prepared for collaboration, partnership & networking research
9.	Establish a national collaboration & coordination mechanism	• Established strategy for national collaboration & coordination

11.4. Promote quality, relevant and multidisciplinary research

S.N	Strategies	KPIs
1	Establish/revise national research quality enhancements mechanisms	• a guideline developed to maintain national research quality
2	Ensure appropriate research accreditation system	• Set research ethics board at national, university and research institute level
3	Promote indigenous knowledge and research	• Number of research conducted on indigenous knowledge

4	Conduct problem-solving and demand-driven research	• Number of problem-solving research conducted
5	Update national research priority areas	• An updated version of the national research priority areas.
6	Increase the country's ranking on the international research indexes	• The improved rank of the country on the international research indexing databases
7	Enhance technology transfer to the end-users/ industries and communities	• Number of technology transferred to the end-users/ industries and communities
8	Ensure economic return from research	• Increased proportion of the contribution of research to the national GDP
9	Improving thematic and multi-disciplinary approaches in research	• Improved thematic and multi-disciplinary approaches in research as per the dynamics of the global knowledge

11.5. Create Knowledge Management System

S.N	Strategies	KPIs
1	Create awareness about knowledge management among all stakeholders	• Number of pieces of training, workshops and forums conducted
3	Establish national research data standards	• A guideline designed to determine national research data standards
4	Establish a national data repository systems and platforms which can store and share different types of data based on disciplines including biodata	• A established a national data repository systems
5	Create mechanisms that enhance information exchange among national, regional, continental, and international scientific agencies.	• Number of networked research institutes and universities with the national data repository center
6	Share perspectives, ideas, experiences, information, study findings and make them available in the right place at the right time to enable informed decisions.	• Number of research findings disseminated to stakeholders on time.
7	Promote utilization of indigenous resources and traditional knowledge.	• Number of brochures, pamphlets, leaflets, and workshops conducted.

8	Evaluate and update the extensive indigenous resources and traditional knowledge	• Number of evaluated and updated indigenous resources and traditional knowledge
9	Automate data management system at institutional and national levels	• Number of data management systems automated at institutional and national levels

11.6. Research governance and organization

S.N	Strategies	KPIs
1	Develop/revise research ethics and conducts	• Developed/ revised research review ethics guideline
2	Develop the competence and skills of researchers and students	• Number of researchers and students trained on research ethics
3	Establish an institutional system for ethical clearance and conduct researches accordingly	• Number of institutions and universities established institutional research ethics review board/ committee
3	Develop/ set of guidelines and checklists to ensure efficiency and effectiveness of research projects.	• A guideline developed to monitor and ensure the efficiency and effectiveness of research projects
4	Establish an organizational structure for effective management of research projects	• Number of research councils established at the institutional level.
5	Design and implement appropriate dissemination mechanisms for research outputs to end-users	• Number of publications produced, • Number of media briefs, • Number of workshops/ conferences conducted; • Number of field visits and days conducted • Number of brochures, pamphlets, leaflets and proceedings made • No of policy briefs produced
5	Develop IP policy	Number of institutes and universities with IP Policy document
6	Establish institutional IP office	Number of institutes and universities with IP Office
7	Establish and strengthen research grant offices	Number of institutes and universities with research grant offices

11.7. Research financing and incentive scheme

S.N	Strategies	KPIs

1	Establish National Research fund and encourage research foundations	• Number of Established National & Sectoral Research Fund
2	Ensure equity (special needs, female researchers) and diversity in the incentive and reward schemes	• Percentage of Increase in available funds for R&D both for • academia and private sector
3	Provide adequate and performance-based government funding for research	• Increase in national R&D expenditure from current 0.0 % to 1% by 2022 (2/3 of the expenditure by Business enterprises)
4	Encourage the industry to participate in financing research	• Increase in percent of the number of research projects funded by regional or international resources
5	Allocate funds to establish research-based enterprises	• Number of Research Grants given to the Private sector
6	Allocate financial resources to transfer proven research outputs to industries	• Number of sectors included in the National Award Program
7	Allocate funds from the internal revenue of the institute for research	• Number of sectors included in the National Award Program
8	Establish a National award & Recognition system for outstanding achievements	• Outstanding researchers, scientists, & students are recognized and awarded at the highest levels Increase
9	Develop a competitive granting system and funding mechanism	• Introduction of financing model stimulating competition, development, and application of problem-based research
10	Establish a Private sector research financing system	• Availability of risk-based finances to support Startups & SMEs in S&T
11	Develop enabling Procurement system for research	• Enterprises created as a result of a research
12	Establish tax exemptions mechanisms for industries involved in research	• Number of research-based industries exempted from tax
13	Ensure the availability of supporting institutions for technology transfer and incubating innovation	• Findings/Commercialize research findings
14	Create mechanisms to use IPs as intangible properties in financing enterprises	• Increase IP based loans to 25% (20% of the total loan given by banks based on intangible assets

12. Annex 2: Definition of Terms

Terms	Definitions
Applied Research	An original investigation undertaken to acquire new knowledge which is directed primarily toward specific practical aims or objectives
Author	a writer who has intellectually created a work in an article, book or any other scholarly work. In the case of a computer program, it means a person who has created the program. There can be more than one author of a single scholarly work.
Basic Research	an original investigation with the primary aim of developing more complete knowledge or understanding of the subject under study.
Collaborative Research or Joint Research	means a scientific investigation or research and development project undertaken jointly by a higher education institution, industry or other governmental and non-governmental organizations based on a research partnership agreement.
Conflict-of-Interest	a divergence between an individual's private interests and his or her professional obligations to the HEI such that an independent observer might reasonably question whether the individual's professional actions or decisions are determined by considerations of personal gain, financial or otherwise.
Consultancy Service	professional or technical service rendered by a staff member of the University to the community.
Contract Research	conduct of a specified research project by a higher education institution for an industry or other public or private organization by using its expertise and equipment in return for the payment of fee.
Copyright	a protection provided by the laws of Ethiopia to its owners.
Community Service	any unremunerated professional service that is performed for the benefit of the public, its institutions, or for non-profit organizations by academic staff and students of HEIs with the knowledge of the responsible office.
Employee	a person who receives a salary or other consideration from the higher education institution for performance of services, part-time or full time.
Governance	the way rules, norms, and actions or decisions concerning research, technology transfer, university-industry linkage, and community service at higher education institutions in Ethiopia are produced, sustained, regulated and held accountable both at the institutional level and at the level of the Ministry.
Higher Education Institution or Institution	a university, university college or college as defined by Higher Education Proclamation No. 1152/2019.

Indigenous or Traditional Knowledge	a knowledge or know-how system owned by cultural, local or indigenous communities or any section of such communities.
Industry	private and public companies, enterprises, farmers, government institutions, and other organizations that deliver services and/or products.
Intellectual Property	an ensemble of rights related to inventions, processes, compositions, and other creations of the mind. It mainly includes patents, copyrights, trademarks, industrial designs, and trade secrets.
Intellectual Property Rights	rights that allow owners of intellectual property to benefit from their work or invention following the laws of the country.
Invention	creation of any useful idea, process, machine or discovery of the composition of matter which solves a significant technological problem or brings a novel solution to a major challenge.
Inventor	a person who has brought one or more new and original elements to an invention.
Innovation	a new way of doing something by improving the process, product/service and strategy either incrementally or radically.
Knowledge Transfer	imparting knowledge to those in the society who can make use of it for the general good through publications, training, and education of students, employment of graduates, conferences, consultations, and collaboration as well as by obtaining rights to inventions and discoveries that qualify for intellectual property protection and commercialization.
Laboratory Staff	academic support staff employed to support the teaching-learning, research, and TT processes of HEIs laboratories, computer centers, workshops and teaching hospitals.
License	agreement-based permission granted by the owner of intellectual property, the licensor, to the other party, the licensee, to use or exploit all or some of the owner's rights.
Material Transfer Agreement	an agreement in which one party agrees to provide physical materials or samples, including non-Human biological materials, chemical compounds, databases, and software codes, to another party for testing, evaluation, or experimentation.
Partnership	a formal arrangement in which two or more parties cooperate to manage and operate an activity of mutual interest.
Patent	a title that confers to its owner the rights recognized by the intellectual property laws of Ethiopia.
Plagiarism	claiming or insinuating ownership of another person's intellectual and/or academic contribution, and it includes (a) using texts of another person without acknowledgment; (b) paraphrasing text without acknowledgment, or (c) using four or more words in the

	same form and sequence from an acknowledged or unacknowledged source without quotation marks and specific page numbers.
Principal Investigator	an individual designated by a HEI or a funding organization to direct the project or program being supported by the fund.
Research	a systematized investigation to search for new knowledge or technology and/or to use existing knowledge or technology in a new and creative way to generate new concepts, methodologies, understandings, and to solve new or existing problems.
Research and Technology Transfer Council	a governing body established to oversee research, community service and technology transfer activities.
Research Grant	a financial contribution by industry or foundation or governmental or non-governmental organization to a scientific research project conducted by a higher education institution
Research Staff	an academic staff who spends more than 60% or more of his time to research activities, and the remaining time for teaching, student advising and community services
Science and Technology Park	facility equipped and managed by a HEI designed to foster university, industry and government collaboration to develop products or processes invented by or in partnership with higher education institutions to bring about knowledge- and technology-based economic development
Start-up Business/Company	a business created by staff or students or other individuals through a technology transfer agreement with a higher education institution that owns the technology being developed and marketed
Student Research	research by students of higher education institutions designed and undertaken in line with the research thematic areas of the institutions for partial fulfillment of the requirements of master's or Ph.D. degree supervised and/or co-supervised by an academic staff member, regardless of the source of funding
Staff Research	research done by research staff or teaching staff members through funding provided by the higher education institution or third parties
Teaching Staff	an academic staff who spends 60% of his time to teaching-learning activities, and the remaining time for research and community services
Technology	a product, process or knowhow of demonstrable benefit obtained through research or independent inquiry or imported or adapted from abroad, which could be disseminated or commercialized for public use

Technology and Business Incubation Center	a unit set up to nurture, accelerate and grow new businesses by providing comprehensive integrated support including infrastructure, incubator space, business support services and clustering and networking opportunities at an early stage of development and change
Technology Transfer	the transfer of technology by higher education institutions for public use, or to industry for further development and marketing in exchange for appropriate type and amount of compensation
Thematic Research	grouping of cross-cutting research problems in a multidisciplinary and integrated manner through the engagement of academic staff and stakeholders from different disciplines working on a similar range of issues in line with local and national priorities
University	a higher education institution as defined by Higher Education Proclamation No. 650/2009
University-Industry Linkage	a system through which HEI and/or their academic staffs interacts with industry through joint research, contract research, research grants, consultancy, community engagement, staff mobility, joint supervision of students, student internships, staff externships, co-operation in education, training of industry staff at higher education institutions and lecturing by industry staff.