The Federal Democratic Republic of Ethiopia

National Science, Technology and Innovation Policy:

Building Competitiveness through Innovation

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1. Introduction

Ethiopia has adopted a national economic policy that mainly focuses on implementing the Agricultural Development Led Industrialization (ADLI). The objectives of ADLI include promotion of economic efficiency and growth, development of domestic technological capacities and capabilities for the promotion and development of small, intermediate and capital goods industries. The real Gross Domestic product (GDP) of the country grew for the seventh time in a row in two-digit rates from 2003/04 through to 2009/10. The registered growth was achieved mainly due to the improved performance of the agricultural sector.

This growth has been achieved through broad-based and diversified activities in which structural transformation was evidenced. Export earnings are steadily increasing owing to the increase in the value and volume of export commodities. As a result of the economic growth, the total imported commodities of the country have also increased. However, it has become clear that the growth of the Ethiopian economy cannot be sustained without building its technological capability. In fact, a closer look into the development phases of the newly industrialized South East Asian countries shows that their success is mostly explained by the countries' outward looking market economies and technological capability accumulation.

This policy is, therefore, aimed at providing the basic framework to initiate, guide, coordinate and support the efforts of the country to acquire, use and master technologies. The document contains the overall policy framework and directions along with major strategies of implementation. The background and elaboration of this policy are contained in the National Science, Technology and Innovation (STI) Policy Green Paper prepared through a series of consultations with stakeholders.

2. Vision, Mission and Objectives of the Policy

2.1 Vision

The vision of Science, Technology and Innovation is formulated on the basis of the national vision stated as: "to see Ethiopia become a country where democratic rule, good governance and social justice reign upon the involvement and freewill of its peoples, and once extricating itself from poverty becomes a middle-income economy." Achievement of the vision requires, among other things, conscious application of science and technology as the major instrument to create wealth. The national STI vision of Ethiopia is, therefore:-

To see Ethiopia undertaking coherent STI initiatives which eventually lead the country to begin exporting its own technologies by the year 2025.

2.2 Mission

The mission of the policy is:-

To create a sound science and technology foundation and to coordinate the national technological capability building efforts so as to enhance competitiveness of the economy, and reduce technological dependence of the country.

2.3 Objectives

The major objectives of the policy are the following:

1. **To create a general governance framework for coordinated and integrated STI capacity building activities;**
2. **To establish a framework for technology accumulation and transfer;**
3. **To develop adaptive research that is geared towards rapid technology transfer and adaptation;**
4. **To develop and commercialize traditional knowledge and technologies;**
5. **To define the national science and technology landscape and to strengthen linkages among the different actors in the national innovation system;**
6. **To ensure integrated implementation of STI activities with other socioeconomic development programs and plans;**
7. **To institute support mechanisms to progressively raise the role of the private sector in undertaking and financing innovation.**

Various countries use numerous indicators to measure their technological capabilities for the advancement of science, technology and innovation. The widely used indicators include research expenditure; number of researchers; number of patents, utility models and technology licenses granted; and number of publications. The milestones presented in Table-1 have been designed to measure the level of achievement of the objectives set within the 2025 time frame. However, it has to be noted that these data alone do not capture the full range of innovative activities in the country.

Table 1: Summary of Milestones

Objective	Baseline (2010 est.)	Targets (GC)		
		2015	2020	2025
Technology transfer & development	No systematic way of technology transfer	There will be Systematic technology transfer	Reduction of technology dependency	Export of Ethiopian technologies
Export promotion	Dominated mainly by primary goods	Export of value added primary products	Export of commodities	Export of high technology products
Industrial capability	Huge unmet demand for manufactured products	Start locally producing basic chemicals and steel to reduce imports Provide local raw material base for the industries	Meet the local demand for steel and chemicals fully Start exporting steel and Engineering products	Adopt international quality standards Innovate new materials and products
R & D capacity	Clear direction decided	Increased imitation/ adoption capability	Increased adaptation capability	Invention through Reserch
GERD/GDP (%)	0.2*	1.0	1.5	2.0
R&D Personnel per 10000 Labor Force	0.46	1	5	18
Patents and utility Models (UM) granted for Residents	Patent 1	10	35	110
	Utility Model 24	240	610	3000

**** This figure is adopted from the 2005 R&D Survey. It is assumed that there is no significant change in the national R&D spending since then.***

3. Policy Directions and Strategies

The following policy directions have been identified based on the analysis of the major STI problems of the country and the review of experiences of the benchmarked countries. The policy directions and strategies are indicated under twelve critical policy issues in which the government intends to intervene to create efficient and dynamic national innovation system for the realization of the country's development vision. The critical policy issues are: National and Regional Innovation Systems; Technology Transfer; Human Resource Development; Business

Enterprises; Research; Financing and Incentives; National Quality Infrastructure; University - GRI - Industry Linkage; Intellectual Property Rights; Science and Technology Information; Environmental Technologies; and International Cooperation. Policy statements are followed by the strategies under each critical area.

3.1 The National and Regional Innovation Systems

Constructive interaction of the stakeholders in the innovation systems through the process of adoption, adaptation, application and generation of technologies and scientific knowledge is a prerequisite to national technological capability building. However, such systems are not clearly defined and organized in Ethiopia. Consequently, technological and scientific activities in the country are not prioritized and coordinated both at national and regional levels. This is because most of the elements are lacking and the interaction among the existing elements is very weak. Thus, National and Regional Innovation Systems shall be established and implemented to foster rapid and sustainable development of the country.

Strategies

1. **Constitute the NIS of Ethiopia under top government leadership.**
2. **Encourage and support establishment and/or strengthening of balanced regional innovation systems.**
3. **Establish regional centers of excellence to undertake research focused on technology adaptation.**
4. **Ensure strong linkage between the Federal and Regional STI activities.**

3.2 Technology Transfer

Technological learning and change in Ethiopia shall take place primarily by improving foreign technologies that are required by the economy. Currently, however, there is lack of systematic transfer of foreign technologies based on the demands of the various social and economic sectors. There is also weak technological capability for the effective absorption of foreign technology. The country shall, therefore, devote resources to assimilation, adaptation and improvement of foreign technologies with prior attention given to development of domestic technological capabilities.

Strategies

1. **Expand the flow of technology through foreign direct investment.**
2. **Promote the development of domestic technological capabilities for the effective absorption of foreign technologies.**
3. **Accelerate inter-firm dissemination of technological information and know-how**
4. **Set national priority programs for the transfer of major technologies.**
5. **Use intellectual property and standards information as sources of foreign technology.**

6. **Access technological information in whatever way.**
7. **Train critical personnel in selected areas.**

3.3 Human Resource Development

The acquisition, diffusion and upgrading of technologies which exist in the more technologically advanced countries require locally available and competent scientists, engineers and technicians. However, the different sectors of the Ethiopian economy face serious shortage of trained manpower who can be actively involved in the imitation of foreign technologies and subsequent innovative activities. Hence, the educational system of the country shall align itself with the national development objectives and prior attention shall be given to the creation of competent and innovative manpower, predominantly in the fields of engineering, technology and natural sciences.

Strategies

1. **Establish specialized science and technology institutions that focus on producing finest scientists and engineers for the economy.**
2. **Sustain the 70:30 university intake ratios in favor of science & Technology for the coming 10 years.**
3. **Develop positive attitude towards TVET programme within the society.**
4. **Create a separate quality assurance center for TVET teachers, SME workers and owners to improve their skill.**
5. **Introduce high quality, dynamic, practical, interactive and attractive science and mathematics curricula at teachers training institutes as well as primary and secondary schools.**
6. **Introduce planned and productive scientific tours and participation of Ethiopian scientists and technologists in conferences, symposia, workshops and seminars-both at national and international levels.**
7. **Train critical number of scientists, engineers & technicians at foreign institutes, labs & schools in a planned way.**
8. **Provide incentives for science. Engineering, technology and mathematics teachers.**
9. **Increase the proportion of female students who enroll in science, engineering as well as in technical fields of TVET Schools.**

3.4 Business Enterprises

The role of business enterprises ranges from performance and support of various STI activities including: research, technology transfer and diffusion to the creation of policy framework. Small enterprises are mainly users of innovation while medium and large enterprises play significant role in technology imitation and adaptation. The major problems that need to be addressed urgently to promote and support small, medium and large business enterprises as important elements of the national innovation system include: lack of processed technological information,

inadequate training capabilities at TVET centers, lack of access to financial and other resources and absence of consultancy support. Hence, conducive and supportive environment should be created for nurturing and developing of innovative business enterprises as important agents of technology transfer and productivity improvement.

Strategies

1. **Strengthen linkages among SMEs and Large Enterprises along the value chain in the various sectors.**
2. **Create SMEs' national council.**
3. **Create the mechanism by which government procurement process is used to strengthen innovative efforts of SMEs.**
4. **Establish an award scheme to recognize and encourage innovative SMEs.**
5. **Create SMEs bank to solve long term financial problems of SMEs including shortage for startups, marketing, expansion, etc.**
6. **Use TVET schools as centers of technology consulting to SMEs to provide them with coordinated and effective extension services.**

3.5 Research

The acquisition, diffusion and improvement of foreign technologies require a considerable local effort which focuses on adaptive research. Research in Ethiopia should address the major challenges of the country and contribute to the achievement of national development objectives. However, there is a disconnection between the focus of the researches undertaken by GRIs and academic institutions and the needs of the major social and economic sectors of the country. Thus, the national research system shall concentrate mainly on adaptation of appropriate foreign technologies to meet domestic needs, with some basic research activities.

Strategies

1. **Reform of the existing Government Research Institutes in a technological capability building perspective.**
2. **Promote demand driven and systematic research activities in the agriculture and health sectors.**
3. **Focus on adaptive research and reverse engineering based on the needs of industry.**
4. **Create and strengthen linkages between GRIs and Industry.**
5. **Create more GRIs to fulfill the necessary research landscape.**

3.6 Financing and Incentives

There are significant financial costs associated with the activities involved in the adaptation and assimilation of appropriate foreign technologies. The current total research expenditure in Ethiopia is one of the lowest in the world. The existing financial system of the country is not also designed to address the needs of innovative activities in the enterprises sector. Therefore, appropriate financing and incentive mechanisms should be created to promote scientific, technological and innovative activities.

Strategies
1. Create national technology and innovation funds.
2. Introduce fiscal incentives such as tax exemption and duty free privileges for scientific, technological and innovative activities of Ethiopian SMEs.
3. Create a system of special privileges and awards for outstanding innovations/achievements
4. Develop and implement pro-innovative government procurement policy.
5. Increase budget allocation for adaptive & applied research at tertiary education institutions and TVET centers.

3.7 National Quality Infrastructure (NQI)

Inefficient use of valuable resources and poor adherence to quality standards are the major drawbacks within the engineering sector of Ethiopia. As a result, standards failed to provide an essential platform on which new products and processes can be built on. In order to tackle the problems related to productivity and quality; and to create competitive manufacturing industry, the national standardization, metrology and conformity assessment services should be reoriented and operated in a concerted manner towards sustainable technological capability accumulation.

Strategies
1. Promote world best practices in productivity, quality, and safety management system arenas throughout the industry.
2. Introduce NQI elements at Universities and TVET schools.
3. Replace traditional measuring technologies by modern measurement technologies.
4. Use Standards as a means for technology transfer.
5. Establish a reliable conformity assessment system to ensure safety and quality of products before they hit the market.
6. Establish an integrated national accreditation system for industry, education and health sectors
7. Make use of more mandatory standards as basis for technical regulatory activities.
8. Establish strong regulatory and enforcement environment for the NQI.

3.8 University - GRI - Industry Linkage

Universities, GRIs and Industries are the major actors in the national innovation system. The strength and productivity of their linkages depend on the orientation and capacity of the actors to be innovative. The current situation in Ethiopia is that the universities are lagging behind the industry sector in-terms of understanding and using technology. This necessitates the linkage to be strengthened with a two way technological flow between the universities and the industries. Their joint efforts shall be focused on identifying technologies and their sources, understanding the technologies through learning-by-doing and adaptation of these technologies. Creating a synergy of Universities, GRIs and Industries in imitating, adapting and generating appropriate technologies through the establishment of strong linkage shall be an urgent task.

Strategies

1. **Allocate an agreed free time for known industrial research professors.**
2. **Establish special funds to encourage joint technology transfer and research undertakings by universities, GRIs and industries in national priority areas.**
3. **Establish mechanisms to regularly exchange personnel among universities, GRIs and industries.**
4. **Encourage and support consultancy business support services of universities to SME startup and expansion activities.**
5. **Change the university curricula to practical, problem solving type that values a good working culture.**

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3.9 Intellectual Property Rights (IPRs)

IPRs can be considered as beneficial when they foster the development of domestic technological capabilities through diffusion of knowledge, technology transfer, foreign direct investments and licensing, among others. However, the intellectual property regime of Ethiopia has played a minimal role in facilitating the transfer of foreign technology and the development of local innovative activities. The national IPR regime shall, therefore, create a conducive environment for imitative learning and the protection of new knowledge; and foster the development of indigenous knowledge.

Strategies
1. Use patent information for technological catch-up. **2. Adapt the national patent system to the needs of local industries and traditional knowledge holders.** **3. Strengthen the national intellectual property system for the regulation of access to genetic resources.** **4. Build the capacity to manage IP both at the national and institutional levels.** **5. Use copyright protection to promote the growth of the creative industries.** **6. Use trademark protection to create and enhance a competitive environment among enterprises.**

3.10 Science and Technology (S&T) Information

In Ethiopia, S&T information is handled in a very fragmented way. There is no systematically collected, organized and processed scientific, technological, and industrial information that can be easily accessed by SMEs, scientists/researchers, entrepreneurs and other stakeholders. National and regional S&T information in the form of statistics, databases, indicators and bibliographies is not also produced on a regular basis and in a systematic way. Accomplishment of this task requires creation of a national information system with the right institutional set up and critical mass of professionals. Hence, the capability to identify, collect, process, organize, disseminate and properly use S&T information shall be developed to support and facilitate technology transfer and diffusion.

Strategies
1. **Create a national science and technology information center.** 2. **Support generation and dissemination of value added STI information, scientific knowledge and technologies.** 3. **Put in place an instrument required to ensure the harmonious management and operation of information resources, services and systems.** 4. **Design an up-to-date STI information capturing mechanisms and create information networks at national, regional and international centers.** 5. **Support research activities related to scientific and technological information collection, processing, management and dissemination strategies and methodologies.**

3.11 Environmental Technologies

The major environmental issues in Ethiopia include the growing problem of desertification, forest clearing and land degradation. Absence of integrated solid and liquid waste management system is also the other environmental problem especially in urban areas. The solution for the major environmental problems of Ethiopia is adoption, adaptation and generation of green technologies in agriculture, energy and water resources use and management.

Strategies
1. **Introduction and expansion of fast growing trees with multipurpose uses including biomass energy, soil conservation and timber and pulp production.**
2. **Locally produce wind mills and solar cells to make solar and wind energies affordable.**
3. **Adopt sanitary landfill solid waste disposal and wastewater removal and treatment technologies in conjunction with generation of energy from solid waste.**

3.12 International Cooperation

Cooperation in the areas of science and technology is essential for accessing technological information, manpower training, expert assistance, scientific visits, collaborative research, joint ventures in technology transfer, and funding of scientific and technological activities. The current international cooperative undertakings of Ethiopia with various countries is not consciously oriented towards facilitating national technological capability building through systematic exchange of S&T information, ideas, scientists and engineers. International S&T cooperation with developed and developing countries as well as multilateral organization shall, therefore, be strengthened with the prior objective of building the national technological capability.

Strategies
1. **Create strong bilateral and multilateral cooperation with countries of the world on concrete programs of cooperation.**
2. **Ensure incorporation of STI capacity building elements in bilateral and multilateral agreements.**
3. **Encourage exchange of students, professors and researchers through South-South and North-South cooperation.**
4. **Redirect most research to take place within the country in collaboration with international institutions.**

4. National Technological Capability Building

4.1 Priority Programs (NTCPs)

Technological capacity building will be undertaken in a coordinated and focused manner to implement the policy through joint efforts of the different actors. This is due to the fact that lack of national technological capability programs including national priority research programs, will lead to chaotic projects that cannot contribute to the national efforts of technology acquirement. The experiences of successful countries shows that they have developed priority programs in the areas where they want to bring breakthroughs. Every country focuses on its particular potential and internal conditions. Hence, Table 2 shows the national technology capabilities recommended for Ethiopia based on its immediate and near future needs of the country.

Table 2: National Priority Technology Capability Programs (NPTCPs) of Ethiopia

No.	Recommended NPTCP	Major Sector (s)
1	**Agricultural Productivity Improvement Program**	Agriculture - Crop Production and Productivity - Livestock Development - Biodiversity Conservation and Sustainable Utilization
2	**Industrial Productivity & Quality Program** ***- Agro-processing*** • Food Processing Technology • Leather & Leather Products Technology • Textile Technology • Sugar Technology ***-Chemicals & Pharmaceuticals*** ***-Metals & Metal Products Engineering***	Industry Industry, Health Industry
3	**Biotechnology**	Agriculture, Health, Industry
4	**Energy Technology**	Energy, Agriculture, Industry
5	**Construction Technology**	Urban Development & Construction
6	**Materials Technology**	Industry
7	**Electronics & Micro-Electronics**	Industry
8	**ICT and Telecommunications**	Communication and Information Technology
9	**Water Technology**	Water, Agriculture, Industry, Urban Development

4.2 S&T Infrastructure

Historical development of countries shows that the complexity and diversity of the elements of the S&T landscape grows with time as the countries become more and more advanced. This is mainly due to the fact that establishing a complete S&T landscape with conspicuous elements requires enormous resources and time. Hence, prioritization of their establishment based on the immediate needs and the strategic moves of the country becomes imperative.

The National Innovation System of Ethiopia is neither complete nor operational. It lacks the necessary legal, institutional and operational elements. It is, therefore, essential to put in place all the required elements step by step. It is also necessary to set priorities based on the urgency and impact of the issues.

4.2.1 Government Research Institutes (GRIs)

The GRIs are primarily envisaged to facilitate the process of technological learning and accumulation by the business enterprises in the priority programs identified in this document. Their major activities will be adaptive research, technology adaptation, and practical training and consultancy services. Table-3 shows the proposed framework that GRIs will be reoriented, reorganized or established. Their implementation will be decided by the National S&T Council based on detailed feasibility studies to be submitted by the Ministry of Science and Technology. The priorities will, in fact, be dynamically readjusted based on the development needs of the country.

4.2.2 National Laboratories

It is mandatory to establish full-fledged national laboratories to meet the demands of the GRIs and business enterprises for world standard accredited analytical services. The laboratories will be engaged in basic and applied research activities. National laboratories will be established first by upgrading the existing laboratories to be followed by establishing new ones. Table 4 shows the proposed national laboratories.

Table 3: Proposed Government Research Institutions (GRIs) by sector

Agriculture	Industry	Communication	Construction	Health	Energy	Water	Cross-Cutting	S&T
EIAR (umbrella org.) • *Livestock Research* • *Crop Research* • *Coffee Research* • *Horticulture Research* • *Forest Research* • *Apiculture* • *Biotechnology Institute*	*Industrial Productivity & Quality Center (IPQC)* • *LLPTI* • *Textile unit* • *Metals unit* • *Chemicals unit* • *Sugar unit* • *Agro-industry unit*	• *Telecommunications & ICT* • *Electronics & Micro-* • *electronics*	*National Construction Research Center (NCRC)*	• *EHNRI* • *National drug Research Institute (NDRI)*	*Energy Research Institute*	*Water Research Institute*	*Materials Technology Research Institute*	*S&T Information Center*

Table 4: Proposed National Laboratories

No.	National Laboratory	Sectors to be served
1	Agriculture (Animal Health, Soil Analysis)	Agriculture, Export trade
2	Chemical and Geochemical	Industry, Water, mining
3	Geotechnical (Soil and Rock)	Construction, Land use, Infrastructure
4	Hydrological and Water Quality	Water, Agriculture, Environment, Energy
5	Medical	Health
6	Electrical	Energy
7	Materials Testing	Construction

5. Implementation of the Policy

The policy provides the basic framework to shape the landscape of the national innovation system and to positively influence the efforts and behaviors of its stakeholders. Creation of a clearly defined and efficient STI governance structure, building the capability to imitate, assimilate, adapt and diffuse technologies and development of qualified scientists and engineers are the top urgent initiatives in implementing the policy. The policy will be implemented under the guidance of the National S&T Council chaired by the Prime Minister with full ownership of the major STI ministries, and with a strong institutional capability of the Ministry of Science and Technology to initiate, coordinate, monitor and evaluate the policy implementation process and the overall STI developments in the country.

5.1 Principles

The implementation of the policy will be based on the framework of principles that are aimed at ensuring an effective and efficient system. The major principles include the following:

- Taking leadership and unfolding commitment of the developmental government for STI capability building.
- Integration of STI activities with other socioeconomic development activities.
- Making the private sector innovative through creation of an enabling environment and provision of selected support aimed at improving competitiveness through technological learning.
- Efficient, effective, accountable and transparent allocation and utilization of

resources to be made available for STI programs, projects and activities.

- Strong cooperation and collaboration of stakeholders at regional, national and international levels for optimal utilization of infrastructure and competence.
- Recognition of best achievements and contributions of organizations and personalities at various levels.
- Facilitation of IPR creation, protection and utilization.
- Promotion of cooperative and competitive practices among business enterprises, personalities and GRIs.
- Conscious and continuous learning from success and failure experiences of other countries, programs and other initiatives.

5.2 Governance

The policy will be implemented by all stakeholders of the National Innovation System. A national governance structure will, therefore, be established to direct, guide and oversee the implementation of the policy. The major actors will be the National Science and Technology Council, Technical Advisory Committee, Ministry of Science and Technology, STI Ministries, Innovation Support and Research Organizations, and Business Enterprises.

5.2.1 The National Science, Technology and Innovation Council

The National Science, Technology and Innovation Council will be chaired by the country's Prime Minister. The council, which is taken as a champion of technological revolution of the country, will be comprised of the following members: top-level representatives of the concerned public sectors, representatives of the private sector and selected renowned scientists and engineers. The following are the proposed members of the Council:

The following are the proposed S&T council members:	
i) The Prime Minister	Chairperson
ii) The Minister of Science and Technology	Member & Secretary
iii) The Economic Advisor to the Prime Minister	Member
iv) The Minister of Finance and Economic Development	"
v) The Minister of Industry	"
vi) The Minister of Trade	"
vii) The Minister of Agriculture	Member
viii) The Minister of Urban Development and Construction	"

ix) The Minister of Education	"
x) The Minister of Health	"
xi) The Minister of Mines	"
xii) The Minister of Water and Energy	"
xiii) The Minister of Transport	"
xiv) The Minister of Communication and Information Technology	"
xv) The Minister of Government Communication Affairs Office	"
xvi) Three renowned scientists, selected on their merit	Members
xvii) Three renowned Individuals from the private sector	"

Some of the main tasks of the council are:

- Debate on the selection, prioritization and adoption of national research programs.
- Debate and approve the research projects as scrutinized and submitted by MoST from all sectors.
- Monitor and evaluate the pace at which technological adaptation takes place in all national priority programs.
- Decide upon the amount of budget share per GDP for S&T.
- Guide and decide on the areas and the pace at which the country is creating competent S&T personnel.
- Approve the country's medium and long-term S&T plan.
- Approve the establishment of S&T foundations, academies, innovation funds etc.
- Approve different S&T guidelines.

5.2.2 Technical Advisory Committee (TAC) of the National S&T Council

The TAC will be composed of renowned and experienced scientists and engineers, representatives of professional associations, GRIs, universities and the three prominent scientists and technologists who are also members of the NSTC. The Committee will be chaired by the minister of S&T and will provide technical expertise, undertake the necessary preliminary work and consolidate matters that will be submitted to the Council. The TAC may also be assisted by sub-Committees like Technical Committees, Expert Panels and Consultants as deemed necessary.

5.2.3 Ministry of Science and Technology and Other S&T Ministries

The policy and the decisions of the Council shall be executed by the Ministry of Science and Technology (MoST) and 12 other Ministries. The effectiveness of the National Innovation System thus partially depends on the level of interaction and coordination among these organizations. The organizational setup shall, therefore, be capable to smoothly run the National Innovation System, to avoid unnecessary duplication of efforts and overlapping of mandates and consequent wastage of the limited resources.

The Ministry of Science and Technology serves as a secretariat to the National Council and it has the overall responsibility of initiating, guiding, coordinating, supporting, monitoring and evaluation of STI activities at the national level. It will, therefore, be the central coordinating agency to which all the relevant technology transfer centers, universities, technical and vocational education and training schools and government research institutes are accountable. This institutional arrangement is believed to make the Ministry a proactive organization capable to lead and coordinate the implementation of the national policy. Structural proximity of organizational instruments to the Ministry would enable fast and full implementation of the decisions of the Council regarding national priority programs; and transformation and reorientation of STI institutions. It would be very difficult to implement such significant measures using institutional instruments accountable to other ministries given the prevailing weak institutional linkages and collaborations.

However, it should be noted that all science and technology related ministries will still have significant roles to play in the national innovation system through their active involvement in human resource development, research, technology transfer and innovation. With regard to research and other technological capability building activities, the concerned ministries shall prepare their plans and submit to MoST for its preliminary evaluation against the national priority programs and submission to the approval of the Council. MoST is also the ultimate coordinator of the STI activities of GRIs and national laboratories including those to be established in various sectors to execute the priority national programs. The Ministry also identifies the weaknesses in the execution and other operations of the National Innovation System and builds the necessary technology transfer and adaptation capacity in the various Ministries, Enterprises, GRIs and Universities.

The Ministry of Science and Technology will, therefore, be the central organ with responsibilities to plan, promote, coordinate, finance and oversee STI activities of the country. It is also responsible to advise the government on issues of policy implementation and international relations. The Ministry will have the mandate also to establish different committees composed of renowned professionals and representatives from the relevant sectors to assist in the implementation of the STI policy and evaluation and prioritization of projects

that are eligible for grants.

5.2.4 The Innovation Support and Research System

This system is believed to be the place where the motor of the entire system lies. It includes the following sub-systems: the Universities, GRIs and National Laboratories, the TVET System, the Financial Support Systems, S&T Parks/Incubators, the National IP-System, Businesses Enterprises and the National Quality System (NQS). These are the major actors which will be engaged in the actual work of technology transfer, diffusion and research; and those who provide the financial, technical, legal and infrastructural support to these activities. The Ministry of Science and Technology will establish its own research institutes and science and technology support centers as deemed necessary particularly in strategic areas that require special attention.

5.3 Legislative Framework

The Ministry of Science and Technology will initiate and coordinate the drafting and promulgation of laws and regulations required to implement the policy. These are the legal instruments related to the obligation to implement the policy, resource allocation, technology transfer, research support, research ethics, human resource development, technical service provision, human and environment safety, and STI infrastructure development.

5.4 Monitoring and Evaluation

A national science, technology and innovation master plan will be developed to facilitate implementation of the policy. Funds for implementation of the plan will be secured from the treasury and bilateral and multilateral STI co-operations. Implementation of the policy requires feedbacks from stakeholders and other concerned bodies on the progress of the activities, for timely corrective measures and for assessing the efficiency and effectiveness of the allocated resources. Monitoring and evaluation mechanisms will, therefore, be established and implemented by the Ministry of Science and Technology as part of its responsibilities to guide and coordinate implementation of the policy.