

A Preliminary Review of the S&T Policy of Ethiopia in the Framework of the National System of Innovation

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Abstract

The Ethiopian Government issued the National Science and Technology Policy in 1993 in response to the realization of the country's weak science and technology capacity, on the one hand, and recognition of the role of science and technology for development, on the other. The major objectives of the policy include building capability to generate, select, import, develop, disseminate and apply appropriate technologies; and improving the knowledge, culture and the scientific and technological awareness of the peoples of Ethiopia.

The purpose of the paper is to examine this policy using the national system of innovation as a policy analysis framework. It is widely accepted that such analysis makes explicit the many different kinds of necessary inputs and interactions to produce an innovative and competitive economy.

Ethiopia needs to pay attention to supporting and promoting innovative activities in conjunction with building its scientific and technological capacity. Appropriate attention needs to be paid to encouraging and supporting SMEs in the national system of innovation and to demand- side interventions, including the use of the government purchasing power. It is therefore high time to review the national S&T policy, taking into consideration the functions and interactions of the stakeholders of the national system of innovation. Measures should be taken to put in place the necessary legal, organizational, operational and financial instruments to make the national system of innovation more relevant, effective, efficient and sustainable. In this paper, a preliminary attempt is made to do this, in the hope that it can provide a useful contribution for further in-depth study of the subject.

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1. Introduction

The level of technological knowledge that is actually in use throughout the entire economy of a country determines the manner in which resources can be combined to yield outputs of goods and services. Development of new technology and its application in the overall production system has therefore been identified as a powerful factor in raising the standard of living. Technological progress has contributed to the improvement of the health of people, increased the amount of their leisure, improved the working and living conditions, and increased their income many folds in different parts of the globe.

Developed countries are able to generate and extensively apply science and technology so as to ensure their development and global competitiveness. They have already created the necessary preconditions for the generation, promotion, diffusion and application of scientific and technological knowledge whereas, in the case of many third world countries, the application of this knowledge in the realization of their development objectives is at a very low level. The daunting challenge centers on how S&T can be developed so as to contribute to a country's socio-economic development objectives.

It is believed that the first half of the 20th century is considered as the beginning of application of modern science and technology in Ethiopia, along with the establishment of higher learning institutions. However, most socio-economic problems of the country are deeply rooted largely in the absence of well-established scientific and technological base to generate and/or select, adapt and innovatively apply scientific and technological knowledge to solve development and environmental problems.

The Ethiopian Government launched the National Science and Technology Policy in 1993 as part of the national endeavor in the fight against underdevelopment. The Policy was issued with due consideration to the existing realities and knowledge spectrum of policy during that time. The major purpose of this paper is therefore to examine the national science and technology policy framework of Ethiopia from the wider perspective of the national system of innovation. In doing so, an attempt has been made to briefly introduce the policy, to identify the major policy directions set to promote innovative activities, and to point out the main strengths and weaknesses of the policy. The gap observed between the intentions expressed in the policy document and their implementation over the last twelve years has also been identified. The paper concludes by suggesting some recommendations regarding the need to use the national system of innovation to revise the policy highlighting some possible policy directions and implementation actions.

2. National System of Innovation

According to the OECD, national system of innovation is defined as “a system of interacting private and public firms (either large or small), universities and government agencies aiming at the production of science and technology within national borders. Interaction among these units may be technical, commercial, legal, social and financial, inasmuch as the goal of the interaction is the development, protection, financing or regulation of new science and technology”. Such a system can

be seen as comprised of a set of functioning institutions, organizations and policies which interact constructively in the pursuit of a common set of social and economic goals and objectives, and which use the introduction of innovations as the key promoter of change.

All countries have, at least in embryo, a national system of innovation. What varies immensely among countries is the extent, efficiency, and effectiveness of their different systems (UNESCO, 1997). Thus, the concept of a “national system of innovation” provides a useful framework for technology policy analysis and formulation since it makes explicit the many different kinds of inputs which are necessary to produce an economy which is innovative and hence competitive in today’s increasingly globalized markets.

The three principal reasons underlie the utility of the concept of a ‘national system of innovation’ as a basic framework for policy analysis are the following:

1. It affords an opportunity to think of means for the promotion of coherence and integration among national activities,
2. It offers a means of identifying what needs to be done without automatically tying the necessary functions to any particular institution or organization which is currently in place; and
3. It focuses attention on ‘innovation’ – on doing new things in new ways – rather than simply on the production of knowledge.

2.1 The Functions of a National System of Innovation

There are six sets of functions of the national system of innovation, the first two sets of which are the exclusive domain of government, while all of the others are the domains of activities of many stakeholders.

Government functions

- Policy formulation and resource allocation at the national level
- Regulatory policy-making

Shared functions

- Performance-level financing of innovation-related activities
- Performance of innovation-related activities
- Human resource development and capacity building and
- The provision of infrastructure.

2.2 Stakeholders in a National System of Innovation

Stakeholders are the set of individuals and institutions that influence and are influenced by the activities of an NSI. They may have different relationships with the system. In any country, the principal groups of stakeholders in an NSI are to be found in government, the business sector, the

education and training sector, within organized civil society, and among interested outsiders. The typical stakeholder groups that exist in the setting of a national system of innovation, according to the experience from South Africa, are shown below (UNESCO, 1997).

A. Government

- Central policy and budgetary agencies
- Relevant Parliamentary or Congressional Committees
- Science councils (or other specialized S&T financing bodies)
- Departments of government with S&T functions (e.g. in health, agriculture)
- State corporations
- Defense forces
- Other government S&T bodies, including regulatory agencies
- Government advisory mechanisms
- Other levels of government (including municipal authorities, especially in the larger cities)

B. Business

- Large local corporations;
- Transnational corporations (TNCs) and their subsidiaries
- Small, medium and micro-Enterprises in the formal sector;
- Micro-enterprises in the informal or subsistence sectors;
- Business associations, producer groups, chambers of commerce

C. Education and Training Institutions

- Universities;
- Technical colleges;
- Teacher training institutions;
- NGOs or private bodies involved in S&T education and training;
- Primary and secondary schools;
- Other education or training institutions

D. Organized Civil Society

- Professional and Academic Societies
- Labour unions, especially those dealing with technical change;
- NGOs interested in technical change;

E. Interested Outsiders

- Other countries, especially the participants in their national systems of innovation;
- Other countries, including primarily both the participants in their national systems of innovation and their Official Development Assistance Agencies.
- Multilateral Agencies (including UNESCO, UNCTAD, UNEP and other S&T-related UN Organizations, the African Development Bank, the World Bank, WHO, etc)

3. The Need for Science and Technology Policy

S&T policy is an integrated sum of principles, strategies, and objectives and actions adopted by a government in response to the realization of the country's weak science and technology capacity, on the one hand, and the critical role of science and technology for development, on the other hand. National S&T policy is therefore required in order to develop long-term national scientific and technological potential and capability to generate and apply S&T for socio-economic development. As a government response to the critical and defining role of science and technology for socio-economic development, S&T policy is, among other things, a call for:

- (i) **Coordination:** to bring about synergy and cost-effectiveness in science and technology activities through conscious and systematized provision of strategic directions and creation of enabling environment.
- (ii) **Priority setting:** to focus on a few, but strategic areas of activities.
- (iii) **Core budget Allocation :** government commitment to allocate an annual core-budget specifically devoted to S&T and create various funding mechanisms, including fiscal incentives, to those engaged in science and technology development activities, in addition to the national core-budget.

3.1 Arguments against a national S&T policy

1. National S&T policies are designed to benefit a national economy by creating and facilitating a competitive edge for the goods and services it produces. A globalized trading arrangement means that not only goods, business, and finance but also S&T move unrestrictedly across national borders. Thus, any possible benefit from national S&T policies will quickly move ("leak") outside a country, and in a globalized world, such policies are therefore doomed to failure.
2. It is generally accepted that national policies are desirable for macroeconomic stability (for example, exchange-rate policies, fiscal balance). Beyond such fundamentals, however, rather than facilitating a national competitive edge, national S&T policy actually prevents development. Effective S&T decisions, it is argued, can only be made at the level of the individual company or firm; approaches to S&T must be entirely flexible to take advantage of rapid technological change; but national (that is, government) policies are necessarily rigid and run counter to the interests of development.

3.2 Arguments for national S&T policy

1. The role of national policy is critical to establishing conditions for developments that go beyond those the market is likely to create (World Bank 1997). In arriving at this conclusion, the World Bank made it explicitly imperative that poorer countries build up the appropriate human capital and fine-tune the complex relationship between the market and society. In

this regard, the World Bank observed that the experiences of the East Asian Tigers, as well as the failures of national efforts elsewhere, strongly support the need for appropriate instruments of modernization, including instruments of national S&T strategy.

2. Firms and companies target the investments that come with globalization, and on which it depends, to locations with a comparative advantage not only in low-cost labour but more often in S&T. Long-term national policies and actions, particularly in Asia, have been critical in attracting and retaining such investments.
3. If the strength of globalization is in its wealth-creating capacity, its weakness, if undirected and uncontrolled, is in its disregard for, and damage to, the environment and in its exacerbation of gross inequalities both within and between nations.

3.3 S&T policy instruments

A policy may remain a mere rhetorical statement if not followed by appropriate policy instruments. A policy instrument comprises the means used to put a given policy into practice. It can be considered the vehicle through which those in charge of formulating and implementing policies use their capability to orient further decision-making by others. Thus it may also be said that a policy instrument is supposed to induce individuals and institutions to make decisions following the collective rationality established by those in power. In short, it is the vehicle or connecting link between the purpose expressed in a policy and the effect that is sought in practice.

An instrument is a complex entity comprising one or more of the following components:

- ***Legal device (legal instrument):*** embodies the policy, or parts of it, in the form of a law, decree, resolution or regulation. Formal agreements and contracts may also be considered here. The legal device goes beyond a policy and stipulates obligations, rights, rewards, and penalties connected with its being obeyed. The intention of the government enshrined in the policy, derives its validity and power from the legal acts put in place by the responsible body in the government structure.
- ***Organizational structure:*** This refers to the state structure or ministry that is put in place so as to ensure the implementation of the policy after it has been adopted. The introduction of a policy does require an institutional framework with unequivocally spelt out duties, responsibilities and accountabilities. Apart from describing mandates the framework delineates the duties and accountability lines of the major actors involved in the national S&T system.

It includes in one hand, one or more existing institutions which may be thought as the hardware” of the organizational structure. On the other hand, the procedures, methodologies, decisions, criteria, and programs of one or more institutions that must be carried out in processing the pertinent information for the purpose of applying the policy. These are considered the “software” of the organizational structure.

- ***Set of operational mechanisms:*** refers to the organizational arrangements (government departments or directorate) created to oversee the day-to-day operation of the policy. These are the levers, or actual means, through which the organizational structure makes decisions

on a day-to-day basis, and attempts to obtain the desired effect the policy, was set out to influence.

4. The S&T policy of Ethiopia

The National Science and Technology Policy of Ethiopia was formulated by the Ethiopian Science and Technology Commission through a series of consultative discussions with the stakeholders during 1987 – 1993. The formulation process involved working visits of task forces to some countries for experience sharing, sectoral S&T situation assessment and a national workshop. The policy was issued in December 1993 by the then Transitional Government. The main reasons stipulated for the enunciation of the Policy include the need for:

- (a) Sustained science and technology capacity building,
- (b) Committing resources for the long term on sustainable basis,
- (c) Avoiding unnecessary duplication of efforts and uneconomical use of resources.
- (d) Reduction of the level of technological dependency.
- (e) Coordination of S&T activities (effective and efficient use of the resources the county can make available for the activities.

The objectives of the Policy are:

1. To build national capability to generate, select, import, develop, disseminate and apply appropriate technologies for the realization of the country's sustainable socio-economic objectives;
2. To improve and develop the knowledge, culture and the scientific and technological awareness of the peoples of Ethiopia, and promote the development of traditional, new and emerging technologies.
3. To make Science and Technology (S&T) activities more productive, efficient and development oriented.

The national S&T policy comprises of policy directives, strategies; and priority sectors and programmes. It also determines the organizational structure of the national S&T system and sources of financial support and the kind of international collaboration deemed appropriate.

4.1 Major policy directives and provisions of the national S&T policy relevant to the National System of Innovation

The following are the policy directives intended to help realize the set objectives and to build S&T capabilities in the priority accorded areas.

1. Build the capacity to search, select, negotiate, procure, exchange and introduce technologies suitable to Ethiopia's socio-economic conditions.

2. Establish and/or strengthen S&T institutes, Research and Development (R&D) centres and support services as necessary and appropriate in the various administrative regions.
3. Establish responsible bodies/organs in every economic and service sector for the execution of S&T development activities.
4. Facilitate conditions for the wider participation of women in S&T activities.
5. Establish a system to encourage young scientists and technologists.
6. Establish a system for a wider popularization of science and technology amongst different nations and nationalities utilizing their languages in order to improve and enrich the S&T culture of the Ethiopian peoples.
7. Create a working environment conducive to encouraging scientists and researchers for better productivity.
8. Ensure rapid dissemination and application of Research and Development (R&D) results.
9. Encourage the private sector and its capital to participate in the promotion and development of scientific and technological activities.
10. Build trained manpower in Science and Technology (S&T) both in quality and quantity.
11. Promote the mutual support between S&T education, research and production.
12. Encourage the improvement, wider diffusion and application of traditional technologies

The national S&T Policy also identifies about twenty strategies to implement the policy directives. Among these, the strategies that refer to the national system of innovation in one way or another include:

1. Develop, strengthen and modernize the country's engineering and technology base to build a strong national economy and to assist the chemical, textile, agro-industry, mineral and other production sectors which are necessary to meet the demand for basic consumer goods.
2. Expand and raise the quality and understanding of science and technology education at all levels of the educational establishments in all regions.
3. Facilitate conditions to create favorable & mutually reinforcing relations between S&T education, R&D, and the production & service sectors.
4. Establish a national S&T information network capable to acquire S&T information relevant to national development needs and suitably process it for dissemination to potential users in government and private sectors.
5. Develop the capacity and the mechanism to search, choose, negotiate, procure, adapt & adopt and exchange technologies that are appropriate and environmentally sound to the Ethiopian socio-economic conditions.
6. Establish a system to encourage and support applied and basic S&T research in areas appropriate to the needs of the country.
7. Encourage and support the publication of books, research results, journals and periodicals of Science and Technology of interest in the different languages of nations and nationalities as appropriate.

8. Build capability and methodology to identify the scientific content of traditional technologies; improve & change those that are useful for wider dissemination and diffusion.
9. Establish efficient mechanisms for a speedy dissemination and application of Research and Development (R&D) results.
10. Develop a conducive working environment and an appropriate career and promotion structure for scientists and researchers and encourage & support the establishment of professional and amateur associations.
11. Prepare awards and prizes for outstanding innovations and productive achievements in the fields of Science and Technology (S&T).
12. Establish an efficient national patent and technology transfer system to promote and support local technological innovations and creative achievements.
13. Promote locally developed material inputs.
14. Encourage the private sector and its capital to participate in S&T development activities through the provision of tax and other incentive mechanisms.
15. Mobilize resources for S&T development and strengthen international cooperation.

The policy also identifies agriculture, natural resources development & environmental Protection, water resources development, energy, industry, construction, transport and communication, mineral resources, health and population planning, education, and new and emerging technologies as the priority sectors. Programmes are also identified for each priority sector.

The National Science & Technology Policy also maps out the governance structure of the National Science and Technology System. Accordingly, the national science and technology system has four management structures: National S&T Council, Technical Advisory Committee of the National S&T Council, Ethiopian Science and Technology Commission, and S&T operational institutes and centers.

The policy indicates that the National S&T Council presided over by the Prime Minister, with a membership of Ministers of selected Ministries is the highest decision making body of the system. The Ethiopian Science and Technology Agency, according to the Policy, is mandated to plan, promote, coordinate, finance and oversee science and technology activities of the country. In addition, the Agency is responsible to advise the government on issues of S&T, implement the government's S&T policy and follow up the appropriate and immediate application of research and development (R&D) results.

Operational institutions are responsible for the actual performance of S&T activities. According to the spirit of the policy, establishment of research institutes, technology centers, design enterprises, and various S&T support services is mandatory particularly in areas requiring special attention. Such operational institutions can be established under the Ethiopian Science and Technology Agency and could either be merged with other relevant organizations or operate as autonomous bodies at the stage of maturity.

Pursuant to the National Science and Technology Policy, sectoral S&T policies on agriculture; health; industry; mines, water, energy and geo-information were also formulated and approved by

the Council of Ministers in 1994. For the implementation of the Sectoral Policies, sectoral Councils composed of professionals and/or institutional representatives drawn from the respective sectors were established to advise the Ethiopian Science and Technology Agency and follow the execution of Sectoral S&T policies and strategies. Although, the Sectoral Council on Agriculture was dissolved following to the establishment of EARO, the other three councils are still functional.

4.2 Strengths and Weaknesses of the National S&T Policy

Strengths

- It provides a comprehensive and broad base that serves as a springboard to initiate formulation of detailed policies and prioritized action programs in the various socio-economic sectors.
- The National S&T Council is organized under the chairmanship of the Prime Minister of the country and membership of Ministers of relevant ministries. This provides the required commitment and leadership for productive and effective business in S&T capacity building.
- The Government is committed to allocate up to 1.5% of annual GDP in order to support and sustain the different S&T activities, build up S&T capability in all sectors and apply generated research results.
- Equipment and materials imported for R&D activities are exempted from all kinds of taxes.
- The policy consists of a number of directives that can be used to encourage, support and coordinate scientific and technological activities of the various stakeholders.

Weaknesses

- The policy does not treat social science as one branch of science and technology.
- There are no clear distinctions between the policy directives and strategies.
- The priority sectors and programs in the policy document do not clearly show priorities.
- The Policy is too much focused on the public sector.
- Demand side government interventions are not well stipulated
- The organizational structure of the national S&T system is centralized type; it does not take into consideration the existing Federal Government Structure.

4.3 Gaps between the Policy and its Implementation

A number of encouraging developments have been observed in Ethiopia since the issuance of the national science and technology policy. The following are the major steps that are recognized by the national S&T system for their potential contribution to building innovative economy in the country.

1. Rapid expansion of elementary, secondary, technical and vocational; and university education (both at undergraduate and graduate levels) through the Government capacity building national program. Growth of the number of universities and colleges and their intake capacities is particularly impressive. The number of universities has increased from two to nine. Participation of the private sector in education is also encouraging.
2. Strengthening of the national agricultural research system through human resource development and infrastructural capacity building of the Ethiopian Agricultural Research Institute and establishment of Regional Agricultural Research Institutes;
3. Technical, financial and administrative support to young graduates of Technical and Vocational Education and Training Colleges to develop and run their own small businesses.
4. Provision of continued government research and development grant to encourage young researchers and promote problem solving applied research;
5. Establishment of a national intellectual property system with the necessary legal, organizational, and operational framework;
6. Creation of conducive business environment that attracted a good number of foreign and local investors to establish business enterprises in agro-industry, manufacturing, construction and services.
7. The aggressive and commendable efforts of expanding ICT use across the country (including the Woreda Net and School Net programs).

Although all the above-mentioned undertakings are basic steps for building and utilizing national S&T potential for socio-economic development, we believe that a lot has to be done yet in a coordinated manner to implement the directives of the national S&T policy and to achieve its objectives. The major problem with respect to the national S&T policy of Ethiopia is therefore mainly the wide gap observed between the statements of the policy and their implementation. The major gaps can be summarized as follows:

- The general directives and strategies of the policy have not been followed by the appropriate policy instruments and action plans as well as prioritized concrete programs and projects that could contribute to the development of national science and technology capability.
- The organizational structure of the national S&T system envisaged in the policy document has not been realized in full. The prevailing situation is that the council is chaired by the Director General of ESTA with membership of State Ministers and vice Ministers. Coordination and prioritization of S&T activities which are multi-sectoral, multidisciplinary and multi-institutional at national level could have been more effectively handled by a national S&T council that is chaired by **the Prime Minister or the Deputy Prime Minister as his representative or a high level minister of with a stature of political seniority.**
- **Absence of legal basis that defines the relationship between the various elements of the national S&T system is also another important gap.** The responsibilities, roles, relationships and accountabilities of the elements of the system have not been legally defined and established. The functional relationships between all the elements are in fact based on their willingness to collaborate and implement the policy.

- Absence of any system to prioritize and allocate resources for the national S&T efforts. **Although the policy stipulates that the Government of Ethiopia is committed to allocate up to 1.5% of the annual GDP for S&T activities in the country, no mechanism has been developed to allocate core S&T resources annually for programs and projects approved by the national S&T council.** It has to be emphasized here that the intention is not on controlling the flow of annual budgets to the various S&T institutions; it should rather be on creating a system by which resources meant for national S&T activities are earmarked and used taking into account national inter-sectoral and inter-regional priorities and needs.
- Equipment and materials imported for R&D activities are exempted from all kinds of taxes according to the policy. **The present practice, however, is that all equipment and materials imported even as donations are taxed.** This does not pose much of a problem for public institutions, as the Government has shown demonstrated willingness to absorb such costs in the annual budgets of institutions. **Probably the problem is when it comes to private and civic institutions.**

5. What needs to be done to strengthen the National Innovation System (policy directions and actions)?

Ethiopia needs to pay attention to supporting and promoting innovative activities in conjunction with building its scientific and technological capacity. It can be clearly seen that the most important issue in the Ethiopian S&T development is not lack of a policy guideline; it is instead lack of systematic efforts to implement the Government policy.

Not enough attention has been given to encouraging and supporting SME's in the national system of innovation (Comment: and removing barriers, their role in innovation, but not R&D, could be elaborated). The major directions of the present national science and technology policy and the attempts to implement it are focused mainly on the supply measures of scientific and technological knowledge generation with inadequate attention to innovative activities at firm level. Revision of the policy should therefore take into consideration all the stakeholders of the national system of innovation and pay adequate attention to the demand side interventions including the use of the government purchasing power.

Given the above it is now imperative to review **the national S&T policy of Ethiopia using the national system of innovation as a framework of analysis.** It is believed that the existing policy could be upgraded taking under review the functions and interactions of the stakeholders of the national system of innovation. Participatory policy formulation, and adoption of policy implementation instruments including legal, operational and financial should therefore be followed to make the national system of innovation more relevant, effective, efficient and sustainable.

The S&T policy review must obviously focus on local conditions because any model that is simply imported is unlikely to yield the desired benefits. Relevant lessons can be learnt about the review procedures and activities from the past experiences of OECD and IDRC (S&T policy review of Chile, China, South Africa, Vietnam, etc. in late 1990s). The essential features for undertaking such a review could be:

- Strong national leadership.
- Participation of S&T-policy professionals from both developed and developing countries;
- Assessment and sharing of previous experiences and the lessons learned from these;
- A substantive national assessment; and
- Combined open examination, and tabulation of national views, observations, and recommendations (obtained from government, scientists, technicians, and the business community) and those of the international team of policy professionals.

6. Conclusions and Recommendations

Although the National S&T policy has some weaknesses, it has provided the basis to consider S&T activities in a national system. In the review, it was observed that the most important issue in the Ethiopian S&T development is lack of systematic efforts to implement the Government policy. It is believed that the existing policy could be upgraded focusing on coordinating, supporting and enhancing interactions of the various stakeholders of the national system of innovation including universities, industry and the government. The following section summarizes the most important points that need to be considered during **policy revision** and subsequent implementation.

- Appropriate policy instruments including legal, organizational, operational and financial should be adopted to make the national system more relevant, effective, efficient and sustainable
- Adequate attention should be given to supporting and encouraging innovative activities at small and medium firm levels.
- Demand side government interventions including the use of government purchasing power need to be applied to promote and support interactions of the stakeholders.
- The organizational structure of the national system science and technology should be based on the decentralized governance structure of the nation to ensure active participation of the federal and regional stakeholders.
- Science and technology capacity building and applications need to be integrated with the overall development plan of the country.
- The capacity to define and make use of policy instruments needs to be developed. Building the capacity to undertake policy analysis as well as to assess and forecast technical change in the country also needs to be accorded priority.
- Banking and financial institutions need to improve their role of fostering technological innovation by introducing **venture and other forms of risk capital** to create new innovative businesses and improve their sustainability.
- It is imperative to install mechanisms by which institutional research capacity is strengthened and/or built based on national priorities.
- **The linkages between industries and higher level technical and engineering establishments and industries of all types should get policy support to enhance their joint technological development and innovation activities.**

- **Business and technology incubators** should be nurtured to provide affordable space and core business support such as business development, financing, marketing, and legal services.
- Adequate scale of investment should be ensured in R&D for the absorption, adaptation and, wherever possible, improvement on and generation of new technology.
- Policies and capacity building efforts are needed to stimulate technology diffusion and its effective usage to the desired levels. These efforts include: a) infrastructure (b) education and human capital building, (c) public and private research activities.
- Capacity building efforts in the national system of innovation should emphasize understanding, adopting and using new technological knowledge by the private and public business enterprises.
- The role of institutions of higher education in producing new knowledge through research, serving as conduits for the transfer, adaptation, and dissemination of knowledge generated elsewhere in the world, and their support to government and business with advice and consultancy services need to be duly recognized in the national system of innovation.
- R&D is essential to maintaining and improving competitiveness. Therefore companies need to be encouraged and provided incentives to spend on R&D to be competitive in an innovation-driven economy.
- Facilitating the linkage between the universities/ research institutes currently engaged in R&D activities and industry via the provision of subcontracting services for basic and applied research needs to be encouraged.

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