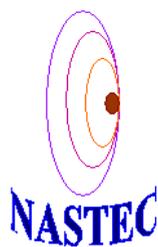


NATIONAL SCIENCE, TECHNOLOGY AND INNOVATION POLICY



NATIONAL SCIENCE AND TECHNOLOGY COMMISSION

2018

Content

| | |
|---|-----|
| Content | ii |
| LIST OF ABBREVIATIONS | iii |
| 1. Effective Date | 1 |
| 2. Introduction..... | 1 |
| I. Background..... | 1 |
| II. Need & Purpose..... | 2 |
| III. Rationale..... | 2 |
| 3. Key Principles | 2 |
| 4. Policy Statement | 3 |
| 5. Policy Goals..... | 3 |
| 6. Applicability & Scope | 4 |
| 7. Plan of Implementation | 4 |
| I. Responsibility & Authority..... | 4 |
| II. Monitoring & Evaluation..... | 4 |
| 8. Glossary | 5 |
| Annexure 01 – Strategies, Challenges and Initiatives..... | 7 |
| Annexure 02 - Proposed Main Agencies for Implementation of Strategies/Initiatives | 37 |
| Annexure 03 - Policy Development Committees | 39 |

LIST OF ABBREVIATIONS

| | |
|--------|--|
| ACCIMT | - Arthur C Clarke Institution for Modern Technologies |
| CARP | - Council for Agricultural Research Policy |
| CPD | - Continuing Professional Development |
| CRI | - Coconut Research Institute |
| CRP | - Collaborative Research Programmes |
| GDP | - Gross Domestic Product |
| GIS | - Geographic Information System |
| HR | - Human Resources |
| ICT | - Information and Communication Technology |
| IDB | - Industrial Development Board |
| IP | - Intellectual Property |
| IPR | - Intellectual Property Rights |
| ITI | - Industrial Technology Institute |
| MOU | - Memorandum of Understanding |
| NASTEC | - National Science and Technology Commission |
| NERDC | - National Engineering Research and Development Centre |
| NIE | - National Institute of Education |
| NRC | - National Research Council |
| NRDF | - National Research and Development Framework |
| NSF | - National Science Foundation |
| OTEC | - Ocean Thermal Energy Conversion |
| QMS | - Quality Management Systems |
| R&D | - Research and Development |
| RRI | - Rubber Research Institute |
| SDG | - Sustainable Development Goals |
| SME | - Small and Medium Enterprises |

- ST&R - Science Technology and Research
- STI - Science Technology and Innovation
- TRI - Tea Research Institute
- TVEC - Tertiary and Vocational Education Commission
- UGC - University Grants Commission

Draft - All Rights Reserved, NASTEC

-DRAFT-

National Science, Technology and Innovation Policy

1. Effective Date

2. Introduction

I. Background

Sri Lanka is a country with a proud heritage of technological advancements in engineering, irrigation, agriculture, and medicine. Even though, with the passage of time, Sri Lanka has fallen behind with respect to the modern global technological developments.

According to the global Science, Technology & Innovation (STI) indicators such as Research and development expenditure as a proportion of GDP, Researchers (in full-time equivalent) per million inhabitants and Proportion of medium and high-tech industry value added in total value added, Sri Lanka is at a lower level compared to other regional countries such as India, Pakistan, etc.

The need for a comprehensive, officially accepted, and consistently implemented national policy on Science and Technology has been felt for a long time. The National Science Council (NSC) initiated work on a National Science and Technology Policy, resulting in the first policy statement in 1978. In 1991, a Presidential Task Force on Science and Technology Development drafted an expanded Science and Technology Policy. The 1994 Science and Technology Development Act resulted in a new body, the National Science and Technology Commission (NASTEC) being established in 1998 with policy advisory functions vested in it.

NASTEC under the advice of Ministry of Science & Technology has developed the National Science & Technology Policy in 2008. In developing this policy NASTEC had gone through an extensive consultation process. The National Science & Technology Policy 2008 comprised of two major aspects; development of Science and Technology in the country, and the application of Science and Technology for national development. These two aspects were thoroughly covered in the ten main policy objectives which were further divided and discussed in policy strategies.

Each policy strategy was further extended to include challenges faced by implementing agencies to implement each strategy and initiatives that can be taken to overcome such challenges.

II. Need & Purpose

It has been a decade since the formulation of the National Science & Technology Policy. Although the policy document has been comprehensive and officially accepted, its contents have not been implemented properly by the relevant implementing agencies.

The issues encountered regarding the proper implementation of the policy include: lack of sufficient financial resources/investment for implementation; lack of proper alignment of the institutions of the Ministries related to Science & Technology as well as other related line Ministries; and inadequate monitoring and evaluation processes regarding the policy implementation.

III. Rationale

Since the formulation of the original policy draft in 2008, Sri Lanka has developed in many perspectives with related to Science & Technology, and most importantly in the aspects of Research, Experimental Development & Innovation by the year 2018. Scientific research provides the knowledge for advancement in technology and innovations. Scientific and technological innovations enable the country to improve competitiveness and productivity giving the means to achieve sustainable socio-economic development.

The need has risen to revise the 2008 policy to emphasis on Scientific Research, Innovation and Commercialization while amending the other policy objectives.

Therefore, the purpose of this National STI policy is to address the proper implementation of Science, Technology, Research, Innovation and Commercialization aspects in Sri Lanka aligning with Sustainable Development Goals (SDGs) and national economic development priorities.

3. Key Principles

- A prosperous nation of scientifically literate people, with highly developed scientific, technological, creative & innovative capabilities leads to a strong and stable economy.
- Long term sustainable national development equally distributed among all parties of the society.
- Well focused application of Science, Technology and Innovation shall create a culture in the society to seek science and technological solutions to address problems.
- Ensuring equal opportunities for all school children for science education shall promote inclusive economic growth of the country.

- Research into the scientific basis of indigenous knowledge and its wider dissemination shall promote use of science technology by the general public intelligently for their own wellbeing.
- Opportunities for successful innovation and technology and recognizing innovators leads to economic growth and social wellbeing.

4. Policy Statement

Sri Lanka to use Science, Technology and Innovation in a sustainable manner to create a science literate society to enable wealth creation to foster healthy living standards of people of Sri Lanka.

5. Policy Goals

1. A science, technology and innovation culture fostered effectively to reach all citizens of the country
2. An enhanced Science and Technology capabilities including infrastructure for national development, national planning process strengthen governance and policy implementation mechanisms in alignment with National Research and Development Framework
3. A strengthened and sufficiently expanded human resource base of scientists and technologists necessary to undertake a leading role in achieving national developmental goals via basic and applied research
4. A developed, or acquired and adapted, appropriate scientific knowledge and technologies to achieve progress in all sectors and for enhancing the country's economy and its global competitiveness
5. A sustainable use of natural resources for development while protecting the environment and ensuring bio security
6. Documented, preserved and researched scientific basis of, and promoted indigenous knowledge based technologies
7. A developed culture of creativity and innovation and protection of Intellectual Property Rights (IPR)
8. Ensure quality standards of Science and Technology Institutions, deliverables and services to national and international recognition

9. Promote the application of Science, Technology and Innovation for human welfare & environmental protection including disaster management, adaptation to climate change, law enforcement and defence to ensure human safety and national security
10. Ensured adequate investments for scientific research, development and commercialization

6. Applicability & Scope

This policy deals with the importance of science, technology, basic research & innovation towards advancement of knowledge and national development. It is applicable to all stakeholders involved in Science & Technology including the relevant beneficiaries and policy planners.

7. Plan of Implementation

National Science, Technology and Innovation Policy include specific strategies, challenges & initiatives (Annexure 01) for policy goals and will serve as the base document for implementation by identified authorities & agencies (Annexure 02).

I. Responsibility & Authority

As the implementation will be under the purview of a range of Science and Technology institutions in the country reporting to various line ministries, the policy recommends the establishment of an inter-ministerial committee chaired by the Head of State with the Minister of Science and Technology as the Vice Chairman. The Ministry of Science and Technology will function as the executive arm of this committee. This will ensure the successful coordination and implementation of strategies and the achievement of policy objectives. Further, this will also give due importance to Science and Technology and significantly help in establishing the required Science and Technology culture in the country.

II. Monitoring & Evaluation

A Monitoring & Evaluation system for policy implementation will be developed by a committee appointed by Ministry of Science, Technology & Research and Department of National Planning.

The Department of National Planning has the responsibility of carrying out monitoring & evaluation to assess the effectiveness of the policy after period of 5 years and use the findings at the next round of policy amendments.

8. Glossary

Accreditation - The process by which a recognized body evaluates the quality of an institution as a whole or of a specific section in order to formally recognize it as having met certain predetermined minimal criteria or standards.

Basic needs – The minimum requirements of a community necessary to sustain life

Basic Research - Theoretical research aimed at discovering scientific principles and facts; opposed to applied research, which puts those principles to practical use

Commercialization - The process of managing or running something principally for financial gain

Critical Technology - A mode of technology in which scientific methods are used to critique the adverse consequences of national development.

Cutting Edge Research – Advanced research in a particular field

Economic Competitiveness – The capability a country or company has to achieve profitability in the market in relation to its competitors

Entrepreneurship - The activity of setting up a business or businesses, taking on financial risks in the hope of profit

Ethical Practices - Avoiding activities or organizations that do harm to people or the environment

Good Governance – The effective and responsible management of an organization, a country, etc. which includes considering society's needs in the decisions it makes

Gross Domestic Product - The total value of goods produced and services provided in a country during one year

Implementation - The process of putting a decision or plan into effect; execution

Incentive schemes - An arrangement under which a company makes extra payments to employees to reward good performance.

Indigenous Knowledge – Knowledge pertaining to subjects originating or occurring naturally in a particular place

Information Communication Technology - All the technology used to handle telecommunications, broadcast media, intelligent building management systems, audio-visual processing and transmission systems, and network-based control and monitoring functions.

Innovation - A new method, idea, product, etc.

Intellectual Property - Creations of the mind: inventions; literary and artistic works; and symbols, names and images used in commerce

Intellectual Property Rights – The ownership of ideas, including literary and artistic works (protected by copyright), inventions (protected by patents), signs for distinguishing goods of an enterprise (protected by trademarks) and other elements of industrial property

Mitigation – Reducing risk of loss from the occurrence of any undesirable event

National Development - A specified state of growth or advancement relating to or characteristic of a nation

National Research & Development Framework – A document that provides helpful guidance to scientists and technologists to align their research and development activities towards the national development agenda of the country

National Research Personnel – Include highly trained researchers, specialists with high levels of technical experience and training, and other supporting staff who contribute directly to carrying out R&D projects and activities

Policy - A course or principle of action adopted or proposed by an organization or individual
Quality Management Systems - A system of standards and practices established within a company or industry to ensure consistent quality of products or services

Quality of Life – The standard of health, comfort, and happiness experienced by an individual or group

Remuneration - Money paid for work or a service

Science - A systematically organized body of knowledge on a particular subject

Scientifically Literate - Having education or knowledge in the area of Science

Small and Medium Enterprises - Non-subsidiary, independent firms which employ less than a given number of employees.

Socio-economic - Relating to or concerned with the interaction of social and economic factors.

Socio-economic Transformation – A process in which an increasing proportion of economic output and employment are generated by sectors other than agriculture

Standards - A required or agreed level of quality or attainment

Sustainable Development - Economic development that is conducted without depletion of natural resources

Technology - The application of scientific knowledge for practical purposes, especially in industry

Tertiary Education - Education for people above school age, including college, university, and vocational courses

Think Tanks - A body of experts providing advice and ideas on specific problems

Vocational - Relating to an occupation or employment

Wealth Creation - Accumulation of assets, especially those that generate income, over a long period of time

Annexure 01 – Strategies, Challenges and Initiatives

| Policy Goal 01: A science, technology and innovation culture fostered effectively to reach all citizens of the country | | |
|--|---|--|
| Strategies | Challenges | Initiatives |
| <p>1-a Provide equal and adequate opportunities for all to acquire a basic science education</p> | <ul style="list-style-type: none"> • To create an interest and appreciation for science among students • To overcome the inequality and inadequacy in human resources for science education in the school system • To overcome the inequality and inadequacy of technology based resources and infrastructure for science education in the school system • Increasing the number of qualified well trained teachers with programmes for regular refresher/upgrading teacher training courses in the University/teacher training collegiate system • To ensure necessary language skills are acquired to face global challenges | <ol style="list-style-type: none"> i. Ensuring that all secondary schools, particularly the rural ones, have trained teachers and facilities for science teaching ii. Regular assessing of the level of teacher training and ensure continuous professional development (CPD) of teachers with promotions and incentives being performance based iii. Collaborating between relevant educational authorities in curriculum development, teacher development and supporting activities iv. Strengthening and utilizing relevant state and other organizations that have the capacity to contribute to improve scientific knowledge v. To equip students with necessary language skills at early stage to access scientific information |

| | | |
|--|---|--|
| <p>1-b</p> <p>Inculcate among students an inquiring mind leading to a culture of innovation and entrepreneurship in everyday life</p> | <ul style="list-style-type: none"> • To promote independent, logical, inquiring and lateral thinking particularly in the younger generation • To ensure that memory-based exam-orientation will not hinder questioning minds and independent & critical thinking • The inclusion of additional supporting activities to facilitate creativeness and innovativeness of students | <ol style="list-style-type: none"> i. Supporting the development and planning of real-time, interactive, problem-oriented and student-centered guided projects and activities in the school curriculum ii. Encouraging field and laboratory exercises as an essential component of science teaching to students iii. The introduction of a system of testing the students' skills and conceptual understanding of the underlying scientific principles in practical applications iv. Establishing science museums and science centers for the popularization and attraction of science and technology among students v. Island wide science exhibition or science quiz program e.g., via social media for enhancing the science knowledge, creativeness and innovations among students vi. Provision of adequate financial remunerations and recognition at the university entrance among students who carried out innovations and innovative projects of scientific excellence and innovativeness |
|--|---|--|

| | | |
|---|---|---|
| <p>1-c Promote an appreciation of Science and Technology among the public, as an essential aspect of a progressive society</p> | <ul style="list-style-type: none"> • Educating the public in the value of scientific knowledge for promoting innovations and entrepreneurship • Demonstrate the value of scientific research & development for national development | <ol style="list-style-type: none"> i. Strengthening vocational and technical education/training, to provide conceptual understanding of scientific principles behind technological applications ii. Establishing science centres and science exploratoria with interactive facilities to expose the students/ public to the concepts of Science and Technology in practical applications and innovations iii. Strengthening organizations that can assist in widening the Science and Technology knowledge base of the general public, particularly the entrepreneurial community iv. Ensure the mass media to actively disseminate scientific knowledge among the general public |
|---|---|---|

Policy Goal 02: An enhanced Science and Technology capabilities including infrastructure for national development, national planning process, strengthen governance and policy implementation mechanisms in alignment with National Research and Development Framework (NRDF)

| Strategies | Challenges | Initiatives |
|---|--|--|
| <p>2-a Progressively increase the investment for Science and Technology up to 1.5 % of GDP by the year 2025, with the public sector contribution being at least 1%</p> | <p>Successive Governments have not considered investment in Science and Technology as a priority. The investment for Research and Development remained around 0.15% of GDP for the past several years (one of the lowest in the Asian region) with a decreasing trend. This figure for developed countries is around 2.3% and around 1% for developing countries. It is necessary to increase the investment significantly</p> | <ol style="list-style-type: none"> i. Carrying out an Impact Evaluation Study on Research and Development outputs in relation to past investment, either institution wise or sector wise relating such outputs to specific national initiatives as far as possible. Methodology needs to be developed to evaluate or estimate these figures at regular intervals ii. Developing and establishing improved, innovative communication routes/methodologies between the Science and Technology community and all stakeholders, in particular with policy makers/politicians, to convince the need for increased adequate investment in Research and Development iii. Establishing where applicable Research and Development funds to supplement state sector investment with contributions from local industries and |

| | | |
|--|--|---|
| | <ul style="list-style-type: none"> Effectively communicating the contribution of Science and Technology to the economy to policy makers/industry/community and that expenditure for Research and Development is an investment for development Data for private sector investments in Research and Development are not readily available, but are estimated to be as low as 1.5% of the country's Research and Development budget. A significant increase is essential | <p>importers of manufactured goods in order to encourage industry sponsored local Research and Development</p> <ul style="list-style-type: none"> iv. Providing adequate incentives and a stable government policy scenario which is transparent and consistent to encourage private sector to invest in development oriented research v. Progressively increasing the state sector investment in Science and Technology up to 1% of the GDP by the year 2025 vi. Facilitate increasing the non-state sector investment in Research and Development by such means as tax exemptions, public-private partnerships and providing for R&D outputs to enter markets so that private sector contribution will rise to at least 0.5% of the GDP by the year 2025 |
| <p>2-b Develop and strengthen the existing Science and Technology institutions and universities to generate quality research and train scientists</p> | <ul style="list-style-type: none"> Research and Development institutions need to better plan and focus research activities within exiting constraints of finances, infrastructure and human resources and yet ensure clear deliverables The current institutional management systems tend to induce good scientists to deviate to management/administration positions for better remuneration, benefits and recognition. Alternative comparable career paths in Research and Development must be established | <ul style="list-style-type: none"> i. Orienting the senior management of Science and Technology institutions to progressive management techniques particularly in research management through training programmes, seminars etc. ii. Establishing state of the art HR systems including career progression pathways, effective performance evaluation and related remuneration systems, and mechanisms to attract and retain mid-level research leaders iii. Upgrading the Science and Technology institutions with necessary infrastructure facilities and equipment to carry out quality research and orienting them more towards achieving practical end results with commercial value, recognizing that fundamental and relevant basic research has to be carried out by specific institutions iv. Establishing a peer-review system for periodical evaluation of academic and Research and Development institutions and developing key performance indices using criteria such as publications, innovations, patents, commercialized technology transfers etc., striking an acceptable balance between different criteria for different institutions |

| | | |
|--|---|--|
| | <ul style="list-style-type: none"> • Inadequacy of funds for maintenance and development of ST&R capability of institutions • Inadequate focused initiatives by individual institutions to generate donor funds from local and foreign sources | <p>v. Considering the peer-review findings as an aspect for state grant support to Research and Development institutions</p> <p>vi. Training and encouraging research staff to actively seek research funding through well prepared proposals</p> |
| <p>2-c Improve the autonomy and flexibility of Science and Technology institutions</p> | <ul style="list-style-type: none"> • Reduced autonomy and flexibility of Science and Technology institutions negatively impact the efficiency and productivity of institutions • The higher level management staff of Science and Technology institutions needs to be trained and strengthened to take decisions and to be responsible for quality outputs and be accountable • With increased autonomy, focused control is necessary to ensure adherence to the institutional management systems such as human resource and quality assurance systems | <p>i. Delegating administrative and financial autonomy to Science and Technology institutions within limits of clearly defined spheres and levels where the responsibility and accountability can be ensured by the Governing Boards of such institutions, and amending relevant Acts and Ordinances where necessary</p> <p>ii. Giving adequate authority for Science and Technology institutions for recruiting scientific staff in line with approved corporate plans and cadre so that the necessary critical mass can be systematically developed and sustained</p> <p>iii. Developing specific fund raising strategies and capabilities within individual institutions with focused and trained personnel</p> |
| <p>2-d Promote strong linkages with global Science and Technology initiatives and with international centres of</p> | <ul style="list-style-type: none"> • Opportunities for linkages with regional countries/institutions are not fully explored by scientists and managers • Paucity of international science conferences held in the country | <p>i. Establishing and strengthening international Science and Technology cooperation agreements with relevant governments international organizations, universities and industries with improved implementation</p> <p>ii. Facilitating international and regional conferences and undertaking focal point work for international/regional programmes</p> |

| | | |
|---|--|--|
| <p>excellence in collaborative Research and Development and technology development</p> | <ul style="list-style-type: none"> • Underutilization of bilateral Science and Technology Cooperation agreements | <ul style="list-style-type: none"> iii. Disseminating information on opportunities for international collaboration, global initiatives and progress of Science and Technology in a timely manner iv. Attracting international organizations to establish research laboratories in Sri Lanka for mutual benefit with agreements to safeguard IPR and national interests v. Attracting international conferences to the country to enable and improve interaction among scientists and technologists |
| <p>2-e Include scientists and technologists in the formulation of national development policies and plans, review strategies, legislation, and in decision-making and implementation, at the national and provincial levels, properly utilizing relevant scientific data</p> | <ul style="list-style-type: none"> • Inadequate systems to integrate Science and Technology input into national planning | <ul style="list-style-type: none"> i. Establishing consultative mechanisms to involve scientists and technologists in the formulation of plans and policies, and in decision making in development planning ii. Strengthening linkages between the policy makers and planners at all levels and bodies responsible for advising the government on Science and Technology policy issues via the necessary administrative, legal and financial instruments iii. Instituting provincial Science and Technology Advisory Cells in order to ensure that relevant scientific data are collated for the province to be used for planning and decision making |
| <p>2-f Conduct annual performance audits of programmes adopted by ST&R institutions by expert committees appointed by the respective ministries of Government with the concurrence of the proposed independent</p> | <ul style="list-style-type: none"> • Absence of an institutional mechanism at the highest level to mandate and coordinate Science and Technology policy implementation and related development activities across all relevant sectors of the government • Need for a periodic review and improved effectiveness of Science and Technology governance | <ul style="list-style-type: none"> i. Establishing an Inter–Ministerial Coordination Committee chaired by the Head of State to mandate the periodic Science and Technology governance review and coordinate Science and Technology policy implementation and related development activities across all relevant sectors of the government. ii. Restructuring, and strengthening the Ministry of Science and Technology with appropriate Science and Technology personnel, and facilitate its functioning as the executive arm of the Inter-Ministerial Committee, to ensure effective implementation of the Science and Technology Policy |

| | | |
|--|---|---|
| <p>national commission and report to an expert committee in the Ministry of Finance and to the Committee of Public Enterprises in parliament for the purpose of development, policy, management and financial decisions</p> | | |
| <p>2-g Establish a national body in the form of an independent Commission reporting to H.E. the President. This commission should consist of experts from key ST&R sectors of the economy with powers necessary to determine, direct, approve and coordinate, notwithstanding the legal provisions of the statutes that govern individual institutions concerned and principal programmes of ST&R institutions so that the institutions will implement the provisions identified in the</p> | <ul style="list-style-type: none"> • Strong bureaucratic cultures in certain institutions developed around values of independence and respect for non-intervention which are likely to be constraining the independent audits by ministerial expert committees • Difficulties of obtaining ready support from government ministries and agencies to align proposals of the National Commission with their own programs which may result in a process of time-consuming negotiations • Harnessing the political will at the top leadership levels for the concept of a National Commission given the comprehensive and overarching nature of its jurisdictions and functions proposed | <ol style="list-style-type: none"> i. Study the mechanisms available in other countries to coordinate ST&R strategies and policies at government level ii. Develop a concept paper on the proposal to set up a National Commission reporting to H.E. the President and discuss it at number of ST&R professional forums during the year 2018 under the sponsorship of NASTEC iii. Discuss the concept paper with relevant political leaders and administrators of the government with a view to improving awareness and to generating consensus among policy makers iv. Draft an Act of Parliament on the subject to give effect to the proposed National Commission by end of 2019 |

| NRDF within the National Science and Technology Policy | | |
|---|---|--|
| Policy Goal 03: A strengthened and sufficiently expanded human resource base of scientists and technologists necessary to undertake a leading role in achieving national developmental goals via basic and applied research | | |
| Strategies | Challenges | Initiatives |
| <p>3-a</p> <p>Increase the number of researchers to reach the world average and develop a critical mass of scientists and technologists trained, particularly in appropriate and advanced technologies, to effectively support the socio-economic needs of the country</p> | <ul style="list-style-type: none"> • Inadequate number of research positions in the public and private sector institutions • Unattractive remuneration and facilities of public sector research positions • Inadequate state/institutional funds for planned training, leading to dependence on donor-funded overseas postgraduate training often irrelevant to needs of the country • Lack of supervisors/ trainers for HR development in specific areas, particularly in advanced technologies • Inadequate collaboration between the state and non-state sectors in HR development • Lack of a coordinated approach to training within the institutions and nationally | <ol style="list-style-type: none"> i. Increasing the number of research positions in the public and private sector institutions ensuring attractive remuneration and facilities ii. Establishing a comprehensive system of training needs assessment of all stakeholders in both the public and private sector in line with national development strategies, to form the basis for training scientists and technologists iii. Establishing and maintaining a dynamic national database of needs and resources including information on scientists and their expertise with collaboration among institutions such as NSF, UGC, NIE, NASTEC, CARP, TVEC and NRC iv. Establishing a competitive, comprehensive structured training scheme for scientists and technologists including an orientation programme at entry level to inculcate basics of research planning, procedures and implementation along with ethics and management skills. v. Strengthening the currently available 'pathways' of training scientists vi. Promoting and Institutionalizing collaborative postgraduate research between the academia and government research institutes (e.g. TRI, CRI, RRI, ITI etc.) and the private sector vii. Promoting split PhD programmes on problems related to country needs. Collaboration between universities and expatriate Sri Lankan scientists presents a special opportunity |

| | | |
|---|--|--|
| <p>3-b</p> <p>Increase the number of engineering graduates and attract engineers to Research and Development while ensuring opportunities for their advanced training with international collaboration and support from the public and private sectors</p> | <ul style="list-style-type: none"> • Insufficient capacity to produce adequate numbers of Engineers to meet the country needs • Lack of facilities for Research and Development oriented postgraduate training of engineers • Relatively unattractive remuneration and facilities in the public sector engineering research positions | <ol style="list-style-type: none"> i. Providing a Research and Development oriented educational facility with international collaboration and support from the public and private sectors, to increase the number of engineers and ensure their advanced training ii. Ensure competitive remuneration schemes for research and development positions |
| <p>3-c</p> <p>Provide opportunities for scientists and technologists to acquire advanced knowledge in research and international practices in Science and Technology</p> | <ul style="list-style-type: none"> • Regional exchange programmes are not effectively exploited • Delayed transmission of information on training opportunities to the relevant institutions • A need for simplified and streamlined travel approval procedures for Science and Technology personnel • Inadequate dissemination of knowledge acquired through training | <ol style="list-style-type: none"> i. Facilitating short visits/ attachments by Sri Lankan scientists in relevant disciplines to regional and international centres of excellence in Science and Technology for familiarization with international practices, updating of Science and Technology capacities and to promote collaborative Research and Development activities ii. Enhancing the capacity of scientific personnel undertaking postgraduate work in local universities by facilitating short term attachments with international centres of excellence iii. Encouraging mechanisms for dissemination of knowledge acquired by scientists during their specialized training abroad to other interested Science and Technology personnel in the country iv. Streamlining procedures for scientists to travel overseas for professional activities |
| <p>3-d</p> <p>Foster collaboration between various categories of personnel in ST&R and</p> | <ul style="list-style-type: none"> • Lack of knowledge and appreciation of integrative approaches to ST&R among personnel on both sides of the divide, Science and Art | <ol style="list-style-type: none"> i. Encouraging by instruments of policy and financing the institutions to develop integrative approaches to programming and R&D |

| | | |
|--|--|--|
| <p>personnel in the Social Sciences, Arts and Humanities for the purpose of developing integrative approaches to Science, Technology, Innovation and Development</p> | <ul style="list-style-type: none"> • Institutional and policy barriers impinging upon ST&R and Social Science personnel in their effort to collaborate at institutional and program levels. | <p>ii. Conducting seminars and workshops for groups of personnel from various interdisciplinary fields on integrative approaches including methodologies of research that provide for quantitative, qualitative and mixed methods of investigation.</p> |
| <p>3-e Develop a cadre of National Research Personnel of high caliber scientists and technologists including Sri Lankan expatriate scientists, who are internationally recognized, offering suitable incentives to enable cutting-edge research</p> | <ul style="list-style-type: none"> • Absence of a mechanism to ensure adequate rewards and recognition for excellence in research and innovations • Current working conditions do not encourage retention of high caliber scientists nor does it attract expatriate scientists | <p>i. Developing a tier based system with appropriate additional remuneration and other incentives to absorb recognized researchers to the 'National Research Cadre' based on internationally accepted criteria</p> <p>ii. Establishing innovative procedures to obtain the expertise of recognized high caliber expatriate scientists, where local expertise is not available</p> |
| <p>3-f Improve the remuneration systems, recognition and incentive schemes, and the working conditions of scientists and technologists in Science and Technology institutions</p> | <ul style="list-style-type: none"> • Remuneration levels are significantly below regional standards • Working conditions in remote locations are far from desirable, with inadequate facilities to ensure a reasonable work-life balance • It is difficult for the regional scientists to keep abreast of recent developments and participate in professional activities • Disparities of remuneration structures and other benefits among different Science and Technology institutions | <p>i. Ensuring that remuneration, benefits and other incentives are at least in keeping with regional standards</p> <p>ii. Improving working and living conditions in regional research locations in order to facilitate work-life balance</p> <p>iii. Encouraging inter-institutional collaboration and scientist visits and exchange by providing the necessary facilities including accommodation at visit location</p> <p>iv. Ensuring that research institutes and universities have comparable recruitment criteria, remuneration levels and other benefits, while leaving room for suitable performance based incentive schemes</p> |

| | | |
|---|--|--|
| | | <p>v. Strengthening public and national recognition schemes that are practiced today such as the National Science and Technology awards and the NSF merit awards, and establishing new avenues for recognition where necessary</p> <p>vi. Establishing systems to identify, expose, train and nurture the qualified, capable and high caliber young scientists and provide career paths for rapid advancement, creating additional opportunities where necessary</p> |
| <p>3-g</p> <p>Ensure opportunities for all segments of the population for vocational and tertiary education in Science and Technology irrespective of gender, language, economic status or similar considerations and attract them to the Science and Technology field for their full and equal participatio</p> | <ul style="list-style-type: none"> • Inadequate facilities for vocational and technical training in the national languages • Inadequate facilities and systems for women to balance domestic responsibilities and professional activities for their full participation • Inadequate financial assistance to economically disadvantaged students for vocational and tertiary education | <p>i. Providing vocational and technical training programmes in the relevant languages</p> <p>ii. Providing measures such as flexi hours, crèches in working places, working from home etc. to accommodate special needs of parents to facilitate their contribution</p> <p>iii. Enhancing financial assistance schemes specifically for economically disadvantaged students in post-secondary education including vocational training</p> |
| <p>3-h</p> <p>Give priority to Research and Development activities which are relevant to national sustainable development</p> | <ul style="list-style-type: none"> • Current investment for research in the identified priority areas in Science and Technology is inadequate • Human resources in the frontier research areas are limited | <p>i. Conducting a needs assessment study to identify and prioritise research in the relevant areas</p> <p>ii. Establishing a coordinated national scheme to up-grade infrastructure of the research institutions and providing enhanced funding</p> <p>iii. Establishing systems and facilities to encourage leading Sri Lankan expatriate scientists to return and contribute to research in the prioritized frontier areas</p> |

| | | |
|--|--|--|
| | <ul style="list-style-type: none"> Inadequate expertise for repair and maintenance of advanced scientific instruments Existing institutions have inadequate capacity to conduct required research in some of the new and emerging fields | <p>iv. Enhancing the funding for research, particularly goal-oriented multidisciplinary research, to address identified national needs</p> <p>v. Setting up strategically located advanced instrument centres with appropriately trained scientists and technologists for operation, maintenance and repair services, closely interacting with universities and Research and Development institutions</p> <p>vi. Establishing new research centres where necessary, with new management and governance mechanisms to ensure their effectiveness</p> |
| <p>3-i</p> <p>Establish research centres to carry out cutting-edge research in collaboration with internationally recognized R&D institutions in areas important for national development</p> | <ul style="list-style-type: none"> Lack of world class facilities for research in emerging sciences and technologies of national importance | <p>i. Strengthen existing Research and Development institutions to establish centres of excellence in appropriate fields, e.g. electronics at ACCIMT, mechatronics at NERD centre and biotechnology at ITI</p> <p>ii. Establish world class new research centres with advanced facilities in emerging technologies of national importance, e.g. nanotechnology</p> |
| <p>3-j</p> <p>Improve ICT infrastructure and mechanisms to archive all data on regular basis and enable access to current data and knowledge in scientific research, technology and innovation to ensure effective networking</p> | <ul style="list-style-type: none"> Unavailability of infrastructure and ICT mechanisms to archive data Poor accessibility to current scientific literature for research scientists and technologists Knowledge management should be recognized as a key tool for improving quality in research and related activities | <p>i. Develop ICT infrastructure and mechanisms to enable all the institutes to online update all data to central repository/archive and to provide access to users</p> <p>ii. Setting up a comprehensive, central digital library of Science and Technology, subscribing to all major international journals, with ready on-line access for all scientists and technologists</p> <p>iii. Promoting the publication of research findings in peer-reviewed journals</p> <p>iv. Improving the quality of national journals including strengthened peer-review processes to achieve standards acceptable to be cited in recognized scientific indices</p> <p>v. Establishing good broadband connectivity and networking amongst Universities, Research and Development institutions, and other relevant stakeholders,</p> |

| | | |
|--|---|---|
| | <ul style="list-style-type: none"> • Good knowledge management systems in Science and Technology institutions are essential for quality research • Inadequate networking among the researchers | <p>facilitating and promoting sharing of data, information and knowledge, and also for use in effective management of joint programmes</p> <p>vi. Developing formal knowledge management systems in Science and Technology institutions</p> |
| <p>3-k</p> <p>Encourage collaborative research partnerships between science, technology and research institutions, industry and society</p> | <ul style="list-style-type: none"> • The culture of the Science, Technology and Research bodies (institutions and researchers) does not encourage partnership building and knowledge sharing • Mutual lack of confidence among universities, Science and Technology institutions and industry • Inconsistency of relevant state policies frequently hinders setting up partnerships with both local and foreign institutions • Inadequacy of platforms for interaction between the Science and Technology community and industry • Intellectual Property Rights (IPR) issues prevent ready collaboration | <p>i. Developing clear institutional policies, approaches and systems for collaborative research partnership management with instruments such as operational agreements and MoUs, in particular relating to IPR</p> <p>ii. Encouraging collaboration by having industry representation in the governing bodies of state sector Research and Development institutions and Universities, as well as have regular consultative meetings with broader participation</p> <p>iii. Promoting and facilitating private sector contribution to research through mechanisms such as research grants, endowment research professorships, funding research laboratories etc. by individual companies as well as industry bodies such as the Chamber of Commerce, Planters' Association etc.</p> <p>iv. Facilitating the exchange of resources (including personnel) among Science and Technology organizations and private industry to promote collaborative Research and Development work</p> <p>v. Enhancing systems for attractive tax and other concessions for industries who significantly engage in innovation through collaborative Research and Development</p> <p>vi. Establishing specially funded multi stakeholder Collaborative Research Programmes (CRPs) to address identified developmental problems that are time, cost and objective bound</p> |

| | | |
|--|--|---|
| | <ul style="list-style-type: none"> Industry preference to acquire technology from abroad rather than through local Research and Development | |
| <p>3-l</p> <p>Ensure that safe, ethical practices and standards are confirmed in all Research and Development programmes/activities</p> | <ul style="list-style-type: none"> Improving the appreciation of values and ethics, on issues such as authorship, plagiarism, reluctance to share knowledge and resources, and insensitivity to national regulations, all affecting the professionalism of scientists | <ol style="list-style-type: none"> Introducing systems in Science and Technology organizations to ensure that their activities adhere to ethical practices and inculcate right values among the scientists and technologists Developing opportunities for institutions and scientists to share good practices related to values and ethics Developing institutional procedures to deal with violations of accepted codes of ethics Ensuring systems and procedures for hazardous waste disposal and occupational safety in laboratories |
| <p>3-m</p> <p>Encourage a national research system under the Ministry of Science, and Technology and Research to facilitate the proposed commission under H.E. the President (section 2-g above) by way of advising on priorities and undertaking coordination, monitoring and evaluation of Research and Development programmes/activities to ensure that they achieve the</p> | <ul style="list-style-type: none"> Inadequacy of current systems to coordinate, monitor and evaluate state-funded Research and Development activities | <ol style="list-style-type: none"> Establishing under the Ministry of Science and Technology a framework (National Research System), which will coordinate, monitor and evaluate all matters related to state funded research including the research programmes, research personnel, infrastructure and other facilities to ensure that the desired socio-economic benefits are achieved. Developing a mechanism for the national research system to liaise with the non-state sector funded research activities |

| | | |
|--|--|---|
| desired socio-economic benefits | | |
| Policy Goal 04: A developed, or acquired and adapted, appropriate scientific knowledge and technologies to achieve progress in all sectors and for enhancing the country's economy and its global competitiveness | | |
| Strategies | Challenges | Initiatives |
| 4-a Facilitate scaling-up of research based innovative processes and technologies to pilot and commercial scales | <ul style="list-style-type: none"> Poor team culture prevents collaborative work among scientists and negatively affects scaling up work Lack of mechanisms and support for scaling-up of research | <ol style="list-style-type: none"> Initiate/develop national level coordination mechanisms for use of facilities and personnel for effective scaling-up of targeted research Improving coordination of, and investment in, pilot plant facilities at appropriate institutions Improving interaction between scientists and engineers at early stages of Research and Development programmes and encouraging team work to enable easy scaling-up of technologies Create awareness and change attitude towards collaborative research through incentives and mechanisms |
| 4-b Encourage industries, Research and Development institutions and universities to give greater emphasis to innovations, technology transfer and commercialization | <ul style="list-style-type: none"> Research and Development output do not match the industrial market demand Technology packages and services should be priced so as to make them affordable to small scale industries and entrepreneurs No specific incentives are provided for industries to promote and adopt local Research and Development | <ol style="list-style-type: none"> Creating mechanisms for regular interactions between R&D institutions, relevant industries and universities Facilitate target oriented R&D activities that are initiated through interactions Establishing technology incubator facilities and promotion of technology fairs |

| | | |
|---|---|---|
| | <ul style="list-style-type: none"> • Poor communication by the Research and Development institutions highlighting their respective outputs as well as not understanding the industry needs • Absence of a mature IPR environment does not facilitate sound technology transfer agreements • Industry often lacks skills to accept, adapt and sustain technology inputs | |
| <p>4-c Facilitate transfer of appropriate technologies to small and medium enterprises, particularly in rural areas, through collaboration among Research and Development institutions, the SME sector and other stakeholders using currently-available and newly-created mechanisms</p> | <ul style="list-style-type: none"> • Technology developed in Research and Development institutions is often not demand based and hence not easily marketable • Coordination amongst relevant ministries/departments and other authorities is essential to link developed technologies and entrepreneurs • Inadequate collaboration between Research and Development institutions, SME sector and other stakeholders, particularly end users at community level • Inadequate focus on dissemination of information on technologies, particularly in Sinhala and Tamil languages • Technology transfer mechanisms at rural level have to be strengthened taking into account their special needs | <ol style="list-style-type: none"> i. Identifying and developing the technologies necessary to improve the productivity and quality of the existing SMEs ii. Identifying and developing the technologies based on sustainable use of locally available natural resources as raw materials for potential new industries, at the regional and rural levels iii. Setting up mechanisms for improved coordination between different stakeholders ministries/ departments/ authorities at the district and divisional levels and with organizations such as Vidatha Resource Centres to facilitate technology transfer iv. Networking Research and Development institutions with the Chambers of Commerce and Industries, national extension agencies such as IDB and grass root level programmes such as the Vidatha programme for identification, development and transfer of technologies |

| | | |
|--|---|--|
| | <ul style="list-style-type: none"> Dissemination mechanisms to the grass roots Lack of targeted/contracted research | |
| <p>4-d</p> <p>Encourage international collaboration in Research and Development activities and joint ventures, for cost effective and rapid transfer of modern technologies, while ensuring adequate controls through well-developed agreements for shared benefits</p> | <ul style="list-style-type: none"> A stable policy environment is necessary to establish joint venture Research and Development and commercial operations Inadequate capacity to negotiate terms and agreements in joint venture activities for equitable sharing of benefits Lack of adequate facilities and infrastructure for establishing international collaborations and joint ventures | <ol style="list-style-type: none"> Developing clear and consistent national policies and guidelines for joint venture operations in Research and Development activity Promoting commercial joint ventures with clear Science and Technology acquisition elements, with local Science and Technology institutions as a partner Ensure that the local capacity to receive and manage the technology is in place Develop local capacity to meet the modern technology Establishing strong partnerships between Research and Development institutions and local counterpart industries, as a necessary precondition for successful negotiation and implementation of joint ventures |
| <p>4-e</p> <p>Facilitate entrepreneurship and foresight activities among scientists, technologists, researchers and inventors</p> | <ul style="list-style-type: none"> Scientific organizations give more recognition for research publications than for commercially viable inventions and innovations that could contribute to industrial and national development / Recognize and promote research which leads to commercialization Develop schemes for scientists and scientific institutions which promote research and development Inadequate rewards to Research and Development Personnel for development of new and innovative products and processes, suitable for commercialization | <ol style="list-style-type: none"> Developing schemes for incentives and recognition to scientists and scientific institutions that promote quality and productivity in Research and Development leading to commercialization of research findings Expose Science and Technology personnel to business culture, and technology foresight activities so as to enhance entrepreneurial thinking |

| | | |
|--|--|--|
| | <ul style="list-style-type: none"> Inadequate institutional support for patenting of innovations of their research staff | |
| <p>4-f</p> <p>Facilitate collaboration on thematic issues/research in order to promote inter-sectorial, inter-institutional, interdisciplinary activities</p> | <ul style="list-style-type: none"> Lack of recognition for thematic research as oppose to individual research Lack of adequate funds Attitude in personal and institutional level | <ol style="list-style-type: none"> Incentives and recognition to collaborative research/publication Make special grant schemes available for thematic research |

Policy Goal 05: A sustainable use of natural resources for development while protecting the environment and ensuring bio security

| Strategies | Challenges | Initiatives |
|--|---|--|
| <p>5-a</p> <p>Promote research related to conservation and sustainable use of natural resources/capital</p> | <ul style="list-style-type: none"> The existence of gaps in the Science and Technology knowledge base related to natural resources and their sustainable use Despite the existence of laws, regulations, fiscal measures, and enactments, exploitation in many instances evade the concepts of sustainable extraction and utilization The natural environment is under serious threat of degradation due to hasty and poorly planned development programmes, often | <ol style="list-style-type: none"> Initiating research programmes on ecosystems and aquatic and terrestrial fauna and flora with special reference to endemic species with a view to conservation and sustainable use within the framework of national development activities Promoting research on plants and other organisms with an emphasis to protect biodiversity Promoting research in propagation, conservation and sustainable utilization of unexploited and under-exploited plants and other organisms of commercial value Promoting research aimed at value addition to plant based natural resources through the production of high quality and standardized end products such as medicines and derivatives of essential oils |

| | | |
|--|--|--|
| | <p>without effective environmental impact assessments</p> <ul style="list-style-type: none"> • Lack of Controlled access to natural resources is important to conserve them and promote their sustainable use for economic and social benefits | <p>v. Researching into quantification of existing carbon assets and identify their potential for economic development</p> <p>vi. Retrieving, collating and packaging the relevant research outputs into policy briefs for effective communication among researchers and policy formulators</p> <p>vii. Develop capabilities to assess and maintain databases on minerals and marine resources</p> |
| <p>5-b Strengthen the capability for effective implementation of laws and regulations to protect natural resources/ capital and the environment</p> | <ul style="list-style-type: none"> • The necessity of updating and widening the scientific knowledge base to enhance the capability for implementation of the laws and regulations • Strengthening of implementation and monitoring mechanism • Implementing agencies need to be strengthened and empowered | <p>i. Updating and widening the scope of scientific knowledge and technical knowhow related to environment and natural resources through research</p> <p>ii. Addressing the issues for lack of proper implementation and empowerment</p> |
| <p>5-c Promote cleaner production technologies</p> | <ul style="list-style-type: none"> • The technology of cleaner production must be supported by Research and Development • The efforts to facilitate, promote, transfer and adopt cleaner technologies needs to be strengthened | <p>i. Providing appropriate Science and Technology support for cleaner production, including replacement of fossil fuel based energy with renewable or cleaner energy sources</p> <p>ii. Providing appropriate Science and Technology support and incentives to adopt cleaner production technologies that generate less waste and improve resource productivity</p> <p>iii. Facilitate industries to apply zero liquid discharges</p> <p>iv. Facilitating recycling and resource recovery technologies</p> <p>v. Providing financial & marketing instruments to industries facilitating application of cleaner technologies</p> <p>vi. Promoting green procurement for the public sector</p> <p>vii. Encouraging green certification for industries</p> |

| | | |
|--|--|--|
| <p>5-d</p> <p>Promote the use of extended cost benefit analysis to give value to environment and green accounting practices</p> | <p>Difficulty in developing reliable and acceptable green accounting system</p> <ul style="list-style-type: none"> • Difficulty in inculcating the value of natural resources to promote sustainable use • Lack of proper mechanism to assess and accounting of natural resources • Adding the value of natural resources in to GDP | <ul style="list-style-type: none"> i. Educating the public to appreciate the value of natural resources ii. Raising awareness among responsible officers in relevant authorities iii. Introduce the value of natural resources in education system of the country |
|--|--|--|

Policy Goal 06: Documented, preserved and researched scientific basis of, and promoted indigenous knowledge based technologies

| Strategies | Challenges | Initiatives |
|--|---|--|
| <p>6-a</p> <p>Devise innovative methods to collect and protect undocumented indigenous knowledge while preserving its root and original meaning</p> | <ul style="list-style-type: none"> • Traditional knowledge and practices are not well documented • The Intellectual property aspects of traditional knowledge and practices, usually in the form of customary obligation to need to protect them. This aspect need to be safeguarded when documenting | <ul style="list-style-type: none"> i. Develop mechanisms to retrieve, collate and document information on indigenous knowledge and practices ii. Establish and improve access to new databases on traditional knowledge and practices, while ensuring Intellectual Property Rights iii. Design and establish a meta-database by a designated state institution for ready access by networked institutions, the researchers and the public |
| <p>6-b</p> <p>Retrieve, collate and safeguard documents</p> | <ul style="list-style-type: none"> • The scientific basis of indigenous practices has not been adequately researched and documented preventing wider adoption | <ul style="list-style-type: none"> i. Researching into the *scientific and medicinal basis as well as social, cultural and spiritual aspects of specific practices in the traditional systems of medicine |

| | | |
|---|--|--|
| <p>available on indigenous knowledge, technologies and practices undertaken to tap traditional/conventional wisdom of people and documents of such knowledge</p> | | <p>ii. Researching into the scientific basis of the traditional knowledge and practices in areas such as natural resource conservation, water management, agricultural practices, construction practices and various cottage level industries</p> <p>* This is not limited to meaning given by the western & modern science only. It includes eastern traditional & indigenous way of thinking as well Need to add a footnote</p> |
| <p>6-c Ensure further development of traditional technologies to promote their application for demand-driven value addition while ensuring Intellectual Property Rights and benefit sharing with knowledge holders</p> | <ul style="list-style-type: none"> • Belief that traditional knowledge under their family chain without exposing for exploitation • Inadequate focus and attention on identification of traditional technologies and further development • Absence of promotional policies and mechanisms for encouraging the development and upgrading of identified traditional technologies • Application of traditional knowledge and practices require a legal framework for protection against unscrupulous exploitation | <p>i. Create awareness among holders of traditional knowledge that there will not be exploitation without ensuring intellectual property rights</p> <p>ii. Create mechanisms to share benefits derived from such knowledge among the holders whilst protecting their moral rights</p> <p>iii. Developing institutional policies and mechanisms that will direct Research and Development institutions and universities to establish research programmes for further development of traditional practices and techniques to viable technologies</p> <p>iv. Establishing national platforms for indigenous knowledge holders, researchers and institutions to gain recognition for further development of indigenous technologies</p> <p>v. Formulating and implementing a regulatory or legal framework for the protection, conservation and sustainable use of traditional knowledge and practices</p> |
| Policy Goal 07 : A developed culture of creativity and innovation and protection of Intellectual Property Rights (IPR) | | |
| Strategies | Challenges | Initiatives |
| <p>7-a Inculcate IP awareness among people and develop an IP</p> | <ul style="list-style-type: none"> • Despite broad-based awareness creating programmes, an effective innovation and IPR culture has failed to take root in Research and | <p>i. Strengthening and sustaining awareness programmes on patenting and IPR law, among the Science and Technology institutions and society at all levels</p> <p>ii. Training of trainers on the significance of safeguarding intellectual property and the importance of registration of patents</p> |

| | | |
|---|--|--|
| <p>culture specifically in Research and Development and educational institutions</p> | <p>Development institutions, as well as among Science and Technology personnel</p> <ul style="list-style-type: none"> Inadequacy of regular programmes to sensitize the society at all levels on the importance of safeguarding intellectual property; the facilities available for protection; and on measures available to counter any infringements of the IPR Law | <p>iii. Promoting awareness of IPR at all levels of general education through appropriate activities</p> |
| <p>7-b Develop/ update relevant legislation, policies and guidelines to protect Intellectual Property (IP)</p> | <ul style="list-style-type: none"> Gaps in the existing IP legislation Inadequacy or absence of institutional policies to protect IP Lack of resources such as financial & logistical to protect inventions internationally | <p>i. Developing update relevant policies and guidelines to safeguard the institutional and individual rights to research information, as well as to assist researchers to protect their inventions</p> <p>ii. Provide necessary resources in order to obtain international patents</p> |
| <p>7-c Establish mechanisms to facilitate scientists, technologists and inventors to protect their inventions and all other IPs and incentivize creativity</p> | <ul style="list-style-type: none"> Inadequate guidance to innovators for protecting their IPs Inadequate institutional initiatives to promote patenting of innovations and research findings | <p>i. Developing systems at Science and Technology institutions for innovators to obtain information on IPR regulations, and guidelines for patenting, and for liaising with the Intellectual Property Office and other concerned organizations</p> <p>ii. Establishing HR policies in order to attract creative minds and reward creativity</p> |
| <p>7-d Establish suitable mechanisms to effectively exploit intellectual properties and promote innovation by providing incentives</p> | <ul style="list-style-type: none"> Lack of effective mechanisms to exploit inventions leading to technology transfer | <p>i. Developing a system to identify undisclosed or unrevealed ideas and concepts, as well as those emerging from innovation promotion activities</p> <p>ii. Encourage scientists and researchers to make use of available IP databases efficiently and effectively</p> |

| | | |
|---|--|---|
| | | iii. Developing schemes to assist innovators to further develop their innovations up to commercial level |
| 7-e Promote programmes to identify and encourage inborn innovative skills and abilities at early stages (eg: Gifted Child Programmes in schools) | <ul style="list-style-type: none"> Lack of identity in our early education system to bring out inborn talents Majority of parents and elders wanting their children to be professionals of their liking (Doctor, Engineer, Lawyer etc.) Education system having unrealistic, unjustifiable and unwanted number of competitions in early education that prevents free thinking | <ul style="list-style-type: none"> i. Propose necessary educational reforms in early education systems in order to identify and promote creativity and innovation from early stages ii. Introduce co-curricular activities in schools such as Gifted Child Programmes that leads to developing skills and creativity iii. Introduce non-competitive education system to develop collaborative learning and team spirit among fellow students |
| 7-f Create a think tanks with inventors, technology developers and visionaries to share and contribute to the national development | <ul style="list-style-type: none"> Lack of suitable mechanisms to bring in appropriate critical mass of individuals into the systems Developed culture in all spheres towards individualism | <ul style="list-style-type: none"> i. Take policy decisions to develop think tanks ii. Provide directives from higher authorities to create think tanks iii. Create system to uphold national development against personal |
| Policy Goal 08 : Ensured quality standards of Science and Technology institutions, deliverables and services to national and international recognition | | |
| Strategies | Challenges | Initiatives |

| | | |
|--|--|---|
| <p>8-a</p> <p>Ensure the effectiveness of activities of the Science and Technology institutions by implementing and maintaining internationally recognized quality management systems with periodical national and international review</p> | <ul style="list-style-type: none"> • The need for implementing recognized quality management systems in Science and Technology institutions is not adequately recognized • Most institutions have no specific budget allocations for quality improvement programmes and developing a quality culture • Lack of competent staff in implementing internationally recognized quality management systems and maintaining them • The prevalence of a wrong perspective that QMS hampers research work | <ol style="list-style-type: none"> i. Increase awareness of the quality management systems amongst the senior managements of Science and Technology institutions and to encourage them to adopt applicable internationally recognized quality management systems ii. Promoting Science and Technology institutions to obtain certification status iii. Enhancing the capacity and the capability of a core group of Science and Technology Personnel at Science and Technology institutions by providing them the required training on basic quality concepts and programs for continual improvement iv. Organizing regular interactive sessions among the institutions to share the experiences and best practices on quality and performance improvement programmes v. Incorporating parameters based on the adopted quality system and the certification status, as criteria to the institutional review process instituted by NASTEC, reflecting quality issues in the overall performance index of the institution vi. Instituting an institutional reward and recognition scheme based on the review outcomes |
| <p>8-b</p> <p>Promote Science and Technology institutions to achieve certification of management systems and laboratory accreditation status wherever applicable as per internationally recognized standards</p> | <ul style="list-style-type: none"> • There is a necessity for institutional senior management to recognize that certification adds value to the established quality systems in creating discipline and gaining credibility • Lack of awareness of the importance of accreditation and certification | <ol style="list-style-type: none"> i. Establishing sound programmes in collaboration with Sri Lanka Accreditation Board for Conformity Assessment, Sri Lanka Standards Institution and other certifying bodies to familiarize the senior managements of Science and Technology institutions and scientists on the importance of quality system adoption and certification, and laboratory accreditation ii. Engaging certifying and accrediting bodies to be proactive in promoting quality systems in Science and Technology institutions and industry, and creating media and public awareness as a pressure factor for the institutions to get certification and accreditation iii. Devising suitable mechanisms to encourage Science and Technology institutions to obtain accreditation for their laboratories iv. Financial rewards for accreditation and legal penalty for non-accredited products |

| | | |
|--|--|--|
| <p>8-c Ensure the effectiveness of certification and accreditation bodies and processes</p> | <ul style="list-style-type: none"> • Lack of recognition & regulations for accreditation and certification • Sri Lanka Accreditation Board for Conformity Assessment needs further capacity development • Regular review of affiliation/ certifying conditions is needed to ensure effectiveness of certifying bodies and processes | <ol style="list-style-type: none"> i. Enhancing the capacity of Sri Lanka Accreditation Board to enable expansion of accreditation activities ii. Ensuring that all certifying and accrediting bodies have formal affiliations or recognition with nationally or internationally accepted organizations iii. Developing a system to ensure that the conformity assessment programmes of institutions and laboratories are carried out at regular agreed intervals by the certifying and accrediting bodies iv. Promote a regulatory mechanism to recognize the importance of accreditation & certification |
| <p>8-d Establish National Standards in addition to International Standards</p> | <ul style="list-style-type: none"> • Lack of awareness and lack of standards | <ol style="list-style-type: none"> i. Establish standards |
| <p>8-e Ensure adherence to minimum ethical standards in the overall institutional performance</p> | <ul style="list-style-type: none"> • Lack of awareness and lack of ethical guidelines | <ol style="list-style-type: none"> i. Create awareness and formulate ethical guidelines |

Policy Goal 09 : Promote the application of Science, Technology and Innovation for human welfare and environmental protection including disaster management, adaptation to climate change, law enforcement and defense, to ensure human safety and national security

| Strategies | Challenges | Initiatives |
|--|---|---|
| <p>9-a</p> <p>Use Science and Technology inputs to ensure security in water, food, shelter, energy, health and well-being</p> | <ul style="list-style-type: none"> • Population growth and economic advancement along with changing life styles negatively impact resource availability • Security in food, water, health, shelter, sanitation and energy are either directly or indirectly associated with uncontrolled and undesirable development processes • Water scarcity being an impending issue, water management supported by Science and Technology inputs should become a key element in national planning • Inadequate use of technology for effective stock piling of food and fuel | <ol style="list-style-type: none"> i. Developing a Science and Technology based national water conservation and management strategy, based on a country wide assessment of surface and ground water resources with respect to quality, availability and demand ii. Facilitate scientific research on cultivation and post-harvest technologies of cereals, field crops and horticultural crops iii. Instituting programmes of waste water management and recycling in the main cities and towns using new or adapted technologies iv. Undertaking research programmes to develop food crop varieties that have low water requirements and/or have the capacity to respond to water stressed conditions v. Conducting scientific studies to develop safe and well-conceived stock piling methodologies for essential basic food items, especially cereals vi. Strengthening quarantine procedures to ensure that organisms threatening food security are prevented from entering the country vii. Conducting research into cost effective construction materials and methodologies, and safe housing and sanitation suited for different locations viii. Conducting multi-disciplinary research on environment related health problems such as the widespread occurrence of kidney failure in the North Central Province and increased prevalence of vector borne diseases |

| | | |
|---|--|--|
| | | <p>ix. Institute research programmes for energy conservation</p> <p>x. Institute research programmes to explore a wide range of energy generating alternatives including dendro thermal power, bio-fuels, solar power, wind power, and ocean thermal energy conversion (OTEC) without compromising the resource needs for food security</p> |
| <p>9-b</p> <p>Promote research on causal factors and effects of natural and man-made hazards to ensure application of findings to support mitigation and management of disasters</p> | <ul style="list-style-type: none"> • Inadequate research information with respect to natural and man-made hazards and disasters • The need for more platforms and opportunities for the interaction of scientists and researchers in the field • Necessity to improve support for research work in the field through increased funding and facilities. • Absence of a protocol for assessments of risks and vulnerabilities associated with various disasters and for identification of strategic management measures • Inadequacy of resolution or limitations of information in maps, or in certain cases absence of maps, of disaster prone areas results in difficulties in developing disaster management programmes | <p>i. Instituting research studies into maintenance and management of critical sites such as dams, reservoirs, drainage systems, wetlands and unstable steep sloping lands, that may increase the risks of hazards</p> <p>ii. Sponsoring research on causal, preventive and mitigation factors of natural and man-made disasters, and disseminating the findings</p> <p>iii. Promoting research on environmental aspects in restoration and rehabilitation of the hazard affected areas, and resettlement of affected communities</p> <p>iv. Using scientific and technology based methodologies such as remote sensing and GIS tools to identify and map hazard prone areas and risk assessment ensuring adequate resolution and detail</p> |
| <p>9-c</p> | <ul style="list-style-type: none"> • Inadequate research activity on mitigation and adaptation measures in relation to climate change impacts | <p>i. Undertaking location specific and national level modeling studies on crop cultivation particularly in rice to understand impacts arising from climate induced changes in respect of water availability, pest damage, soil nutrients etc.</p> |

| | | |
|---|--|---|
| <p>Address mitigation, vulnerability and adaptation aspects in respect of climate change effects through application of research and implementation of findings</p> | | <p>ii. Developing suitable adaptation methods for anticipated impacts due to climate change</p> |
| <p>9-d Promote crime prevention and human safety through the application of Science and Technology methodologies</p> | <ul style="list-style-type: none"> • Science and Technology methodologies are not adequately used to ensure security from crime • Absence of a national information sharing framework in relation to crime • A country-wide communication and information dissemination facility using mobile and radio telecommunication systems is important • Increased reliance on forensic science for detection and investigation of crimes is important | <p>i. Establishing a mechanism for improved interaction between police and scientific community for identifying research based solutions for prevention and detection of crime</p> <p>ii. Establishing a broadband ICT facility for a National Operations Room which links institutions dealing with information on public security, law and order, and defence, with a public help desk to facilitate rapid communication and action in relation to crime detection</p> <p>iii. Strengthening the human resource base for effective application of forensic science in crime detection</p> |
| <p>9-e Ensure national security and defence capability through research and modern Science and Technology interventions</p> | <ul style="list-style-type: none"> • The need for increased Research and Development efforts in relation to national defence issues | <p>i. Developing technical and human resource capabilities through activities including the establishment of bilateral and multi-lateral links amongst scientists in areas such as defence technologies including technologies pertaining to control of and defence against chemical, biological and nuclear weapons</p> |

| | | |
|--|---|--|
| | <ul style="list-style-type: none"> • Need for a scientific system to collect and analyze intelligence information on unconventional weapons • Bilateral as well as multi-lateral national defence and security agreements for exchange of information on technologies and material support is important • Need to rapidly acquire information regarding modern defence technologies • Necessity to enhance the Science and Technology capability of personnel in the use of modern defence applications | <ul style="list-style-type: none"> ii. Instituting a scientific system for collection and analysis of intelligence information on unconventional weapons and developing related response plans through research iii. Strengthening facilities and enhancing human resource capability in Research and Development to deal with country specific defence issues |
|--|---|--|

Policy Goal 10 : Ensured adequate investments for scientific research, development and commercialization

| Strategies | Challenges | Initiatives |
|--|--|--|
| <p>10-a Encourage investments for medium & high tech industries</p> | <ul style="list-style-type: none"> • Inadequate infrastructure facilities to set up high tech industries leading to high initial investment cost • Inability to sell the products at globally competitive prices due to high production cost • Need of adhering to a vast number of rules, regulations, and policies discouraging the investors | <ul style="list-style-type: none"> i. Increasing infrastructure facilities suited for setting up high tech industries ii. Developing incentive schemes which reduce high production cost iii. Reducing the unnecessary controlling channels |

| | | |
|--|---|--|
| <p>10-b</p> <p>Encourage public private partnerships to increase investments in Research, Development & Commercialization</p> | <ul style="list-style-type: none"> • Inability of State funded S&T institutes to involve with private sector due to restrictions in existing government protocols • Delays in negotiation due to confusion over government objectives and evaluation criteria | <ul style="list-style-type: none"> i. Developing the appropriate legal framework to facilitate direct approach by private investors ii. Strengthening public sector capacity/capability by the support of private sector |
| <p>10-c</p> <p>Policy inputs in the financial sector that enable financial availability for commercialization of new technology</p> | <ul style="list-style-type: none"> • Banks to develop necessary loan schemes for industry partners to invest in new technology to improve safety, environmental conservation, output and quality. | <ul style="list-style-type: none"> i. Establishment of start up companies and availability of financial support for small and meddium industries to invest in new technology |
| | | |

Draft - All Rights Reserved - NASTIC

Annexure 02 - Proposed Main Agencies for Implementation of Strategies/Initiatives

| Policy Goals | Agencies/Organizations |
|--|---|
| <p>Policy Goal 01</p> <p>A science, technology and innovation culture fostered effectively to reach all citizens of the country</p> | <ul style="list-style-type: none"> -Ministry of Science, Technology & Research and Vocational Training -Ministry of Education -Universities, UGC -Ministry of Industry & Commerce -NIPO, NIE, NSF -SLAAS, and other professional associations |
| <p>Policy Goal 02</p> <p>An enhanced Science and Technology capabilities including infrastructure for national development, national planning process strengthen governance and policy implementation mechanisms in alignment with National Research and Development Framework</p> | <ul style="list-style-type: none"> -Ministry of Science, Technology & Research -Ministry of Finance -Department of National Planning -NSF, NRC -UGC, ICTA -SLAAS and other professional associations -NASTEC |
| <p>Policy Goal 03</p> <p>A strengthened and sufficiently expanded human resource base of scientists and technologists necessary to undertake a leading role in achieving national developmental goals via basic and applied research</p> | <ul style="list-style-type: none"> -Ministry of Science, Technology & research -Ministry of Education -Ministry of Finance -Department of National Planning -Ministry of Higher Education -NEC, NIE, UGC, universities and higher education institutes -NSF, NERD Centre, ITI, ICTA, SLIC, IFS, NRC -NASTEC -DMS, Salaries and Cadre Commission -Ceylon Chamber of Commerce |
| <p>Policy Goal 04</p> <p>A developed, or acquired and adapted, appropriate scientific knowledge and technologies to achieve progress in all sectors and for enhancing the country's economy and its global competitiveness</p> | <ul style="list-style-type: none"> -Ministry of Science, Technology & Research -Ministry of Public Enterprise -Ministry of Industry & Commerce -Ministry of National Policies & Economic Affairs -NSF, NRC -CARP |
| <p>Policy Goal 05</p> <p>A sustainable use of natural resources for development while protecting the environment and ensuring bio security</p> | <ul style="list-style-type: none"> -Ministry of Mahaweli Development and Environment -Ministry of Agriculture -Ministry of Power and Renewable Energy -DWLC, Forest Department, PGRC, NPQS -Sri Lanka Customs |
| <p>Policy Goal 06</p> <p>Documented, preserved and researched scientific basis of, and promoted indigenous knowledge based technologies</p> | <ul style="list-style-type: none"> -Ministry of Mahaweli Development and Environment -Universities -Research Institutes |

| | |
|--|--|
| <p>Policy Goal 07 A developed culture of creativity and innovation and protection of Intellectual Property Rights (IPR)</p> | <ul style="list-style-type: none"> -NSF, NRC, CARP -NIPO -Ministry of Education -NIE, NEC, UGC -Ministry of Higher Education -Universities |
| <p>Policy Goal 08 Ensure quality standards of Science and Technology Institutions, deliverables and services to national and international recognition</p> | <ul style="list-style-type: none"> -SLSI, SLAB -NSF, NRC, CARP -NASTEC |
| <p>Policy Goal 09 Promote the application of Science, Technology and Innovation for human welfare & environmental protection including disaster management, adaptation to climate change, law enforcement and defence to ensure human safety and national security</p> | <ul style="list-style-type: none"> -Ministry of Defense -Minister of Public Administration & Management and Law & Order -Ministry of Mahaweli Development and Environment -Ministry of Power and Renewable Energy -Ministry of Finance -Department of National Planning -Ministry of Health, Nutrition and Indigenous Medicine -Ministry of Irrigation and Water Resources & Disaster Management -Ministry of Agriculture -Sri Lanka Customs -Research Institutes -Ministry of Megapolis -CHPB, SLAEB -NSF, NRC, CARP -NPQS, Department of Animal Production & Health -NASTEC -Ministry of Provincial Councils & Local Government |
| <p>Policy Goal 10 Ensured adequate investments for scientific research, development and commercialization</p> | <ul style="list-style-type: none"> -Ministry of Finance -Ministry of National Policies and Economic Affairs -Ministry of Industry & Commerce -Ministry of Development Strategies and International Trade -Ministry of Science, Technology & Research -NSF, NRC, CARP |

Annexure 03 - Policy Development Committees

Expert Committee I – Policy Elements: *Science, Technology and Innovation Culture*

1. Prof. Arjuna P. de Silva
2. Prof. K.M. Nalin De Silva
3. Eng. D.D. Ananda Namal
4. Dr. Shanthi Wilson
5. Dr. G.B. Gunawardana
6. Dr. T.A.R.J. Gunasekara

Expert Committee II – Policy Elements: *Technology Transfer, Quality and Performance of S and T Institutions*

1. Prof. W.A.J.M. De Costa
2. Prof. D.A. Tantrigoda
3. Prof. T. Jayasingam
4. Mr. L.H.D. Bandusoma
5. Mrs. W.N.N. Satharasinghe

Expert Committee III – Policy Elements: *Human Resource Base, Research, Capability in Science and Technology for National Development*

1. Prof. Gunapala Nanayakkara
2. Prof. M.J.S. Wijeyaratne
3. Prof. Ruchira Cumarathunga
4. Dr. N.P. Wijayananda
5. Dr. K. Arulananda

Expert Committee IV – Policy Elements: *Science, Technology, and Human Security*

1. Prof. Nedra Karunaratne
2. Prof. Ananda Jayawardana
3. Prof. Nalini Ratnasiri
4. Dr. Gerry Jayawardana
5. Prof. M.M.M. Najim

Expert Committee V – Policy Elements: *Indigenous Knowledge, Innovations and Intellectual Property Rights, Natural Resources and the Environment*

1. Prof. W.L. Sumathipala
2. Prof. J.C.N. Rajendra
3. Dr. Sirimal Premakumara
4. Mrs. G.R.Ranawaka
5. Dr. Thamara Dias
6. Mr. Mathugama Seneviruwan
7. Ms. Nilmini Wickramarachchi

Policy Development Consultants