INTEGRATING INTELLECTUAL PROPERTY INTO INNOVATION POLICY FORMULATION IN SRI LANKA

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EXECUTIVE SUMMARY

Background - In 2009, Sri Lanka emerged from a conflict that had hampered its development for 30 years determined to accelerate its economic development. A number of ambitious policies recognizing the centrality of science and technology to that objective were introduced.

Objective – The objective of this project is to understand the innovation system of Sri Lanka and to examine the extent to which intellectual property considerations have served or could serve to strengthen innovation and make recommendations, as appropriate. Following a desk review stage where the main actors, institutions and policy initiatives were identified, a five day visit took place in June 2014 where face to face interviews were held with selected actors and representatives of institutions. Based on these findings this report was prepared.

Our findings include:

- Policies - A number of policies have been promulgated but implementation has been slow. Responsibility for research, science and technology is spread amongst many ministries and government agencies creating inefficiencies and a lack of coordination.
- Science - Interest in science as well as the number of scientists seem to be in decline. Primary role of scientists in universities is considered to be to teach and not research. Research that is undertaken is mostly fundamental or basic research, as opposed to applied, industry driven research. This is further compounded by the lack of funding, inadequate facilities and cumbersome procurement policies.
- Intellectual property management – There is little or no intellectual property policies at universities, no dedicated technology management offices, confusion about whether universities are allowed to commercialize, the requirement of joint ownership of intellectual property by Government in certain cases operates as an obstacle to research collaborations, lack of clarity on ownership of intellectual property produced in universities, the absence of industry engagement by universities etc.
- Skills – absence of commercialization skills within universities, intellectual property management skills in the enterprise sector and patent drafting skills.
- Good practices - the Sri Lanka Institute of Nanotechnology, the industry funded research centers at the University of Moratuwa, National Science Foundation policy on ownership of research output it funded, Sri Lanka Inventors Commission and Zone 24x7.

Recommendations: These comprise suggestions for improving the policy and legal framework, research capability and the management of research output. They advocate conducting patent database searches; suggest measures for building linkages between research and industry, for enhancing skills and for using bio diverse resources in research and call for balance in assessing competing calls for research support.

CHAPTER 1 – BACKGROUND

> *"Under-development in the fields of science and technology has been one of the reasons for our country being economically backward. Over a long period of time in the past, we have also been accustomed to the importation of developed technological products. In general, we cannot be too pleased about the priority accorded to technological progress in our country."*
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> *"Mahinda Chinthana" (Mahinda Vision), 2005, His Excellency Mahinda Rajapaksa President of the Democratic Socialist Republic of Sri Lanka, page 57*

In 2009, Sri Lanka emerged from a conflict that had lasted 30 years. During this period, other developing countries had moved ahead economically, some in leaps, with the investment in science and technology in those countries contributing significantly to their economic development, and to the standards of living of their people. Sri Lanka, on the other hand, having to focus upon its internal conflict, was hampered in its ability to make a similar investment in science and technology. Other developing countries that were once comparable with Sri Lanka have today economies that are more mature and complex, and which are significantly more developed than Sri Lanka's economy. Since emerging from its conflict, Sri Lanka has committed to doing what it takes to accelerate its economic development. On many criteria, including the enviable rate of Sri Lanka's annual economic growth, Sri Lanka has performed impressively.

A number of ambitious policies have been introduced to push science and technology along, all recognizing the importance of the contribution that science and technology can make to Sri Lanka's economic development and the improvement in the lives of its people. These policies also record Sri Lanka's under performance in science and technology in previous decades.

Sri Lanka performs poorly in relation to the percentage of its manufactured exports:[1]

Percentage of Manufactured Exports	
Sri Lanka	~5%
Malaysia	~24%
Thailand	~53%
Singapore	~56%

[1] Derived from graph appearing in Unstoppable Sri Lanka 2020, Public Investment Strategy 2014-2016. Ministry of Finance and Planning, page 174.

It also performs poorly in relation to the value of its high technology exports which declined by more than half in 2009 when the conflict ended, and have not yet returned to previous levels.[2]

Value of High Tech Exports	
2002	~ USD$19m
2003	~ USD$23m
2004	~ USD$61m
2005	~ USD$100 m
2006	~ USD$72m
2007	~ USD$109 m
2008	~ USD$102 m
2009	~ USD$45 m
2010	~ USD$58 m
2011	~ USD$60 m
2012	~ USD$61 m

Despite Sri Lanka's policies recognizing the importance of the contribution that science and technology can make to its economic development, and given its determination to invest in science and technology, to date, implementation has been slow.

The Executive Director of the Lakshman Kadirgamar Institute for International Relations and Strategic Studies, Asanga Abeyagoonasekera recently said, "Sri Lanka which was ranked at the 69th place in the Global Information Technology Report in 2013, has been placed in the 76th place in 2014." Our position has declined seven places. This is not a positive sign."[3]

The purpose of this report is to map the current policies, programs and initiatives designed to promote an innovative economy and to examine to what extent intellectual property considerations have been integrated into such policies, programs and initiatives, identify gaps and needs, if any, and on that basis make recommendations on steps that could be taken to improve the climate of innovation. The recommendations will, in particular, examine the extent to which the intellectual property system can serve to promote a more effective innovation system.

[2] *Ibid* page 173
[3] Abeyagoonesekera A, welcome address to the Lakshman Kadirgamar Institute's seminar "Unleash your Mind for Tomorrow: Spurring the Growth of Innovation in Sri Lanka" 25 November 2013 http://www.kadirgamarinstitute.lk/media/press_release/PRESS%20RELEASE%20-%20Sri%20Lanka%20needs%20%20a%20National%20Roadmap%20for%20Innovation%20says%20Director%20Abeyagoonesekera.pdf

CHAPTER 2 - METHODOLOGY

For implementing this project the following methodology was followed:

1. Desk review – A desk review of the innovation system of Sri Lanka, as evidenced by the various strategies, laws as well as studies conducted on the system was undertaken. Through this process, the broad contours of the innovation system in Sri Lanka were mapped and the main institutions and people that could be contacted for more in depth information were identified.

2. Interviews – However extensive a desk review may be it cannot replace the information that can be gathered by talking to people face-to-face. Only by talking to experts and/or stakeholders on the ground is it possible to gauge the documents and statistics in terms of their relevance and correctness. Thus, after conducting the desk review, interview guidelines designed specifically for each of the types of innovation experts and/or stakeholders (representatives from the university sector, industry, patent attorneys, ministries, intermediaries, etc.) were developed. A five day fact finding mission followed on June 2 to 6, 2014, where face-to-face interviews were conducted with the stakeholders listed in Annex 1 (duration of an interview on average, one hour). Skype facilitated interviews took place over the weeks following the interviews with stakeholders, to seek clarification, or to gather new information from them. The information gathered from the interviewees constitutes the heart of the learning gained in this project.

3. Report – on the basis of these interviews complimented by the information gathered during the desk review stage, this report was developed which suggests some recommendations that could be considered by the Government of Sri Lanka for integrating intellectual property considerations into the innovation policy of Sri Lanka.

CHAPTER 3 - INNOVATION SYSTEM IN SRI LANKA

3.1 POLICY AND LEGAL FRAMEWORK

In *Sri Lanka the Emerging Wonder of Asia "Mahinda Chinthana" – Vision for the Future, 2010* (Mahinda's Vision), it says in the context of creating a modern economy through science and technological innovations "The vision of this strategy is to make Sri Lanka a leader in knowledge creation and innovation in Asia by establishing a world class national research and innovation ecosystem which will generate the necessary strategic, sustainable innovations and technologies to win the 'economic war' by focusing on areas of co-competencies and resource linked opportunities, whilst upholding sustainable principles and preparing our people for a knowledge society through improved literacy in science.[4]

In 2008 a National Science and Technology Policy was formulated by the Ministry of Science and Technology, and it was adopted the following year.

The Policy proposed ten policy objectives:

1. Foster a science, technology and innovation culture that effectively reaches all citizens of the country.
2. Enhance science and technology capability for national development, make use of science and technology expertise in the national planning process, and strengthen governance and policy implementation mechanisms.
3. Build up, and progressively expand and improve the resource base of scientists and technologists necessary to respond to the developmental needs of the country.
4. Promote basic, applied and developmental research, particularly in areas of national importance and priority.
5. Develop, or acquire and adapt, scientific knowledge and technologies for transfer to achieve progressive modernization of all sectors and to enhance the country's competitiveness in the world economy.
6. Ensure sustainable use of natural resources for development while protecting the environment.
7. Document, research into the scientific basis of, and promote indigenous knowledge based technologies.
8. Develop a culture of innovation and intellectual property and ensure the protection of intellectual property rights.
9. Ensure quality standards of science and technology institutions, products and services to achieve national and international recognition.
10. Promote the application of science and technology for human welfare, disaster management, adaptation to climate change, law enforcement and defense, to ensure human and national security.

Some of these policy objectives are echoed in subsequent policies and strategic plans. At about the same time in 2009 the Ministry of Science and Technology with the National Science

[4] See http://www.treasury.gov.lk/publications/mahindaChintanaVision-2010full-eng.pdf at page 137

Foundation and the National Science and Technology Commission released *the National Biotechnology Policy,*[5] which focuses on:

- The commitment for research in biotechnology, and the commercialization of those research outcomes.
- Influencing public awareness of, and perceptions about biotechnology.
- Human resources development in the area of biotechnology.
- The sustainable use of bio diverse resources.
- Fostering entrepreneurship in biotechnology.
- Establishing centres of excellence in biotechnology parks.

In 2010, the Ministry of Technology and Research released its **"***Science, Technology and Innovation Strategy for Sri Lanka 2011-2015***"** ("the Strategy"). The Strategy formulated a number of goals, as well as objectives to be achieved:

Goal 1: Harness innovations and technologies to generate and improve products and services as a way of increasing exports, with amongst its objectives:[6]

- increasing high technology exports from the then current 1.5% of exports to 10% of exports by 2015
- replacing imports
- fostering technology transfer.

Goal 2: Establish a world class research and innovation eco-system with amongst its objectives:[7]

- establishing a system of research and development governance
- attracting, building, and retaining human capital
- modernizing science and technology infrastructure
- increasing funding for research and development
- facilitating international partnerships and collaboration.

Goal 3: Prepare Sri Lanka for a knowledge based society, with amongst its objectives:[8]

- attracting students to science
- creating awareness of the benefit of technology to industry.

Goal 4: Sustainability in all fields of science, including economic, environmental, and social sustainability.[9]

The Coordinating Secretariat for Science Technology and Innovation (COSTI)[10] was set up in 2012 to coordinate the implementation of the Strategy, and in 2013 it released its *National*

[5] http://www.motr.gov.lk/web/pdf/biotechnology_policy.pdf accessed on August 13. 2014
[6] "Science, Technology and Innovation Strategy for Sri Lanka 2011-2015" Ministry of Technology and Research, page 21 http://www.motr.gov.lk/web/pdf/science_technology_and_innovation_strategy.pdf accessed on August 13, 2014
[7] Ibid page 39
[8] Ibid page 73
[9] Ibid page 84
[10] http://www.costi.gov.lk/

Coordinating and Monitoring Framework document.[11] The task is a mammoth one for COSTI and so far only limited progress has been made in the implementation of the ambitious Strategic Plan.

In 2013 *"Unstoppable Sri Lanka 2020, Public Investment Strategy 2014-2016"* was released by the Ministry of Finance and Planning. It aims to achieve:

- Sri Lanka becoming a US $ 100 billion economy by 2016, and a US $ 185 billion economy by 2020
- Sri Lanka increasing per capita annual income to USD$4,470 by 2016 and to USD$ 8,500 by 2020.

Chapter 6 is devoted to "Building a Culture of Innovation and Research" and it focuses on:

- building research infrastructure at four regional universities in particular, and a number of research institutes
- selecting priority areas for development
- enhancing the technological and scientific resource base, and
- technology transfer to the grass roots level (that is, to villages and to micro and small to medium enterprises).

The outcomes anticipated include:

- increasing the number of researchers
- developing high-technology enterprises, and
- expanding capacity in science and technology.

It identifies the following priority areas:

- research that is development oriented
- research that will assist import replacement, and
- research to help develop manufacturing sectors.[12]

Amongst the stated aims is to increase hi-tech exports from 1.5% to 10% by 2016.[13]

Recently, in July 2014, a key initiative of the Ministry of Technology and Research, the *Investment Framework for Research and Development, 2015 – 2020* was adopted for implementation.[14] The Framework identifies ten national priority areas and ten intervention methodologies as follows:

[11] http://www.costi.gov.lk/index.php/en/ accessed on August 13, 2014
[12] "Unstoppable Sri Lanka 2020", Public Investment Strategy 2014-2016. Ministry of Finance and Planning page 172
[13] Ibid page 173
[14] http://www.motr.gov.lk/web/index.php?option=com_content&view=article&id=238&Itemid=38&lang=en

Ten Focus Areas	Ten Interventions
Water	Policy studies
Food, Nutrition and Agriculture	Pure and applied research
Health	Innovations
Shelter	Information and communication technology
Energy	Nanotechnology
Textile Industry	Biotechnology
Environment	Indigenous knowledge and intellectual property rights
Mineral resources	Testing and standardization
Information communication technology and knowledge services	Capacity building
Basic Sciences, Emerging Technologies and Indigenous Knowledge	Popularization

The Honorable Minister for Technology and Research in launching the new Framework stated[15] that Sri Lanka's growth should be one that is innovation-driven and outlined the following requirements for such a strategy to be successful:

- investments should be mainly on applied and developmental research, and on innovation,
- an environment conducive for research and innovation should be created,
- investments and market stimulation for commercialization of innovations should be promoted,
- a consistent percentage of Sri Lanka's Gross Domestic Product (GDP) should be invested in research and development and
- there should be a stable innovation environment.

The ten priority areas identified for intervention during 2015 to 2020 would require an investment of Rs50 billion and is expected to come from contributions from both the state and the private sectors.[16]

[15] A New Narrative for Economic Growth, By Patali Champika Ranawaka, Minister of Technology and Research, Speech made at BICOST on 7th July 2014 at Waters' Edge, Colombo, Sri Lanka http://www.motr.gov.lk/web/images/speech.pdf

[16] ibid

3.2 GOVERNMENT SECTOR

The Ministry of Technology and Research is responsible for formulating and implementing technology and research related policies, programs, and projects. The primary focus of the Ministry is to ensure an alignment of the activities of all the Institutions under it with national objectives and to strengthen research-industry tie ups so that industry is benefitted from research findings to add value to products. The following research and other scientifically and technologically related institutions[17] come under its purview:

- Sri Lanka Institute of Nanotechnology (Pvt.) Ltd
- National Research Council
- Institute of Fundamental Studies
- National Engineering Research and Development Centre
- National Science Foundation
- National Science and Technology Commission
- Sri Lanka Accreditation Board for Conformity Assessment
- Sri Lanka Standards Institute
- Planetarium
- Sri Lanka Inventors Commission
- Atomic Energy Authority
- Arthur C. Clarke Institute for Modern Technologies
- Industrial Technology Institute.

According to various gazette notifications[18] its subjects and functions include the following:

1. Formulation of policies, programs and projects in regard to the subjects of technology, research and all subjects that come under the purview of departments and statutory institutions brought under its purview.
2. Direction of the implementation of such policies, programs and projects within time lines agreed with the national planning authorities and within budgeted resources, with a view to achieving relevant objectives.
3. Reforming of all systems and procedures to ensure the conduct of business in an efficient manner deploying modern management techniques and technology where applicable while eliminating corruption and waste.
4. Provision of all public services that come under the purview of the Ministry in an efficient and people friendly manner.
5. Scientific and industrial research.
6. Establishment and control of standards.
7. Socio-economic research.
8. Planning and conducting research by providing required facilities to research and research institutions.
9. Researches in specific areas of basic science and promotion of fundamental studies.

[17].http://www.motr.gov.lk/web/images/document/subjects.pdf/
[18] ibid

The Ministry of Industry and Commerce is responsible for the industrial development of Sri Lanka. The areas of emphasis in the Ministry are:[19]

1. Diversified high value added industry base
2. High economic growth
3. More employment opportunities
4. Environment sustainability
5. Sustainable industrial development, and
6. Regional industrial development.

The Ministry of Higher Education is responsible for all matters affecting higher education in Sri Lanka. The University Grants Commission is the apex body of the university system.

Numerous other Ministries are also directly involved in innovation in Sri Lanka. For example, the Ministry of Health awards research grants for health related research, and the Ministry of Agriculture is responsible for many research institutes in the agricultural sector.

The Coordinating Secretariat for Science, Technology and Innovation (COSTI) was formed on February 1, 2013 with the function of coordinating and monitoring science, technology and innovation in Sri Lanka. COSTI's main objectives are:[20]

1. Establishing an Inter-Ministerial Steering Committee for Science Technology and Innovation to coordinate all activities including funding in Science Technology and Innovation with the Ministers of Technology and Research, Higher Education, Agriculture, Plantations, Industry and Commerce, National Resources and Enterprise Development, Education, Youth Affairs and Skills Development, Telecommunication and Information Technology and Information and Mass Media.
2. Setting up of National Operational and Coordinating Councils.
3. Establishing a Secretariat to centralize, institutionalize and support the coordination and monitoring activities related to science technology and innovation.
4. Developing and operating a National Science, Technology and Innovation Coordination and Monitoring System (NSTICAMS) to coordinate and monitor all activities related to science, technology and innovation across more than 25 ministries and more than 70 institutions.

[19] http://www.industry.gov.lk/web/index.php?option=com_content&view=article&id=91&Itemid=54&lang=en
[20] http://www.costi.gov.lk/index.php/en/coordinating/coordination-framework

3.3 RESEARCH AND EDUCATIONAL BASE

Sri Lankans have a high level of education, with 90% of the population being literate. Science and engineering education in universities is world class, with many of their graduates obtaining high level employment in other countries. Of these universities:[21]

- 15 universities come under the authority of the University Grants Commission.
- Two universities under the authority of the Ministry of Education.
- One university under the authority of the Ministry of Defense.
- One university under the authority of the Ministry of Vocational and Technical Training
- One university under the authority of Ministry of Youth Affairs and Skills Development.

The University of Colombo, the University of Moratuwa and the University of Peradeniya undertake the bulk of research activity amongst Sri Lanka's universities.

Universities in Sri Lanka reportedly have historically had a low level of research activity, the prime duties of university staff being teaching and education, with research having a lesser priority. Areas of research strengths reported by universities include:

- Engineering (in all fields)
- Computer science
- Agricultural fields
- Biotechnology.

There are 44 research institutes operating under 17 different Ministries, including:

- Research institutes undertaking research in specific agricultural sectors, such as tea, rice, coconut, rubber and sugar cane.
- Research institutes focused on specific areas of research such as medical research.
- Research institutes focused on specific industrial sectors, such as aerospace, nanotechnology, and aquatic sciences.
- Research institutes focused on areas related to fisheries and livestock

While there are a relatively large number of research institutes, many of them are quite small in size. One of the larger research institutes is the Industrial Technology Institute, which employs approximately 250 research and technical staff, and engages in research across a number of fields, including nanotechnology, biotechnology, food industries, natural products, materials science, and chemical engineering.

Reportedly, the laboratory facilities and research equipment at universities and research institutes are ether lacking, or is old and difficult to maintain and repair. This also hinders the level of research activity that universities and research institutes are able to pursue.

The Ministry of Technology and Research's 2010 publication "Science Technology and Innovation – Strategy for Sri Lanka 2011-2015" reported[22] that as at 2010 Sri Lanka had 4,600 researchers. However, some being only engaged part time in research, there were only 2,700 full time equivalent researchers. It also reported that with the world average, according to

[21] http://www.ugc.ac.lk/en/universities-and-institutes/list.html
[22] "Science Technology and Innovation – Strategy for Sri Lanka 2011-2015" Ministry of Technology and Research, 2010, p55

UNESCO being 894 researchers per million of population, that Sri Lanka should have 18,000 researchers. Alarmingly, it also reported a decline in the number of researchers in Sri Lanka from 6,000 in 1996 to 4,520 in 2006. With such few researchers in the country, and their number declining, Sri Lanka is hindered in its ability to have science and technology contribute to the economic development of the country.

The Ministry's 2010 publication also reported that Sri Lanka expended only 0.13% of its GDP on science and technology, while the amount of expenditure in other countries well exceeded that amount.

Comparing two key indicators as of 2006, namely the number of researchers per million population, and research and development expenditure as a percentage of GDP, between Sri Lanka and other countries, the report found that Sri Lanka performed poorly in relation to both indicators:[23]

Researchers per million people	
Sri Lanka	138
Malaysia	509
Singapore	5,479
Korea	3,723
China	714
United States	4,628

R&D expenditure as percentage of GDP	
Sri Lanka	0.17
Malaysia	0.63
Singapore	2.36
Korea	2.99
China	1.34
United States	2.68

One way that investment in science and technology impacts upon an economy is the corresponding level of high technology exports. The report states that Sri Lanka's high technology exports were at 1.5%, compared to the more impressive levels of Thailand (27%) and Malaysia (50%). While this level of high technology exports is attributable to many factors, not just the number of researchers in Sri Lanka, that factor is a major one.

The National Higher Education Strategic Management Plan of Sri Lanka, 2012-2015 Mid Term Plan therefore includes amongst its goals increasing the employability of science graduates from 68% in 2011 to 90% by 2015.[24] It also includes amongst its goals the modernization of engineering and science laboratories and equipment.[25]

[23] *ibid* p55
[24] National Higher Education Strategic Management Plan of Sri Lanka, 2012-2015 Mid Term Plan, Goal 3, Objective 1 p13
[25] National Higher Education Strategic Management Plan of Sri Lanka, 2012-2015 Mid Term Plan, Goal 12, Objective 2 p21

3.4 INDUSTRIAL BASE

Sri Lanka's economy has historically been based on the export of agricultural products including tea, rubber, coconut and spices. Today this still accounts for a large proportion of Sri Lanka's economic activity, with agricultural products contributing approximately 21% to GDP, and providing employment for 38% of Sri Lanka's workforce.[26] The largest exports today are apparel (~18%), followed by tea (~13%).

A fast growing export sector is the broad information technology (IT) sector, including IT software development, knowledge process outsourcing, and IT enabled services. The Government aims that this sector should generate at least US$1 billion in export revenue, and provide employment for 100,000 Sri Lankans by 2016.[27]

Over time, Sri Lanka has demonstrated a growing manufacturing and service sectors. The export of tea, rubber and coconut once accounted for 90% of export earnings in the 1950s, but today accounts for less than 16%, and manufactured products once accounted for 1% of export earnings in the 1950s, but today accounts for more than 60%.[28] The manufacturing sector contributes 19% to Sri Lanka's GDP, and employs 17% of the workforce.[29] A large part of this manufacturing sector is made up of low technology manufacturing, such as the apparel industry, and producing rubber based products for export.

Sri Lanka's industry has not had a significant record of innovating and undertaking research and development. This is changing however, as is evident from the initiative of five companies in establishing the Sri Lanka Institute of Nanotechnology (SLINTEC) as a company dedicated to undertaking research in the nanotechnology field. This is also evident from the six research centers at the University of Moratuwa which are fully funded by Sri Lankan companies.

Anecdotally, one large Sri Lankan company which historically demonstrated little motivation to engage in research and development, recently established its own in-house research and development department, as well as entering into a number of agreements by which it outsourced other research and development to researchers in Sri Lanka, as well as to overseas researchers.

Statistically, more interest by industry in research is suggested by the increasing number of patent applications by Sri Lankan applicants. The National Intellectual Property Office patent application statistics for recent years are referred to in Chapter 4. A noticeable increase in patent applications by Sri Lankan residents occurred in 2007, with that increase being maintained in following years. A further noticeable and this time very significant increase took place from 2011 to 2013, when the number of patent applications by Sri Lankan residents increased from 194 to 328.

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[26] http://www.nationsencyclopedia.com/economies/Asia-and-the-Pacific/Sri-Lanka-OVERVIEW-OF-ECONOMY.html
[27] http://www.investsrilanka.com/key_sectors_for_investment/knowledge_services_intro.html
[28] http://www.nationsencyclopedia.com/economies/Asia-and-the-Pacific/Sri-Lanka-OVERVIEW-OF-ECONOMY.html
[29] http://www.nationsencyclopedia.com/economies/Asia-and-the-Pacific/Sri-Lanka-OVERVIEW-OF-ECONOMY.html

Innovation and undertaking research and development in Sri Lanka, having been neglected for so long during the years of conflict, is now certainly growing, albeit slowly, and producing more beneficial outcomes. .

> Zone 24 x 7
>
> Illustrating that applied research can contribute to economic development in a faster timeframe is the outstanding Sri Lankan company Zone 24x7, which develops electronics, and integrates electronics with software. It employs 117 engineers located in Sri Lanka, all of which are graduates of Sri Lankan universities. 98% of its business however, is directed to customers located in the United States. 40% of its projects are instigated by its US customers. 60% of its projects are instigated in-house, after being assessed that their outcomes will be of interest to the company's US customers. The company owns 12 US patents.

3.5 INTERMEDIARIES, INSTITUTIONS AND ACTORS THAT SUPPORT THE INNOVATION SYSTEM

The Lankan Angels Network (LAN)[30]*- The LAN* is a network of approximately 60 angel investors[31]. LAN is the conduit between entrepreneurs that do not meet the lending criteria of banks, and individuals that are willing to provide capital to these entrepreneurs, in return for equity in their companies. Investment opportunities are presented to LAN, and LAN brings the availability of the opportunity to the attention of the angel network. Those individuals that are prepared to invest then syndicate their investment into the entrepreneurs' company. LAN was formed only a few years ago so the number of companies in which angels have invested in are few (12), and there have not yet been any exits.[32] LAN's main criterion for investment is entrepreneurship and the entrepreneur's capability to succeed. Intellectual property is not the main investment criteria. This accords with how angel networks work elsewhere in the world, where it is the business opportunity, and the drive, motivation and passion of the entrepreneur that the angels invest in, since these are the main criteria for success. An outstanding invention with robust intellectual property protection will not necessarily be successfully commercialised without that drive, motivation and passion of the entrepreneur. LAN is willing and looks forward to appropriate technology opportunities to invest in.

LAN serves an important function in the innovation cycle, providing risk capital to entrepreneurs that otherwise would have no access to such capital. There is reportedly only one venture capital firm in Sri Lanka, and it has made a number of investments.

The National Chamber of Commerce of Sri Lanka[33] – This was formed in 1948 to be a forum for, and to promote the interests of Sri Lankan businesses. It operates across all sectors of

[30] http://www.lankanangelnetwork.com/default.php
[31] An angel investor is usually, a former entrepreneur or professional who provides starting or growth capital in promising ventures, and helps also with advice and contacts. See http://www.businessdictionary.com/definition/angel-investor.
[32] An investor exits the company and recoups his investment when that company lists on a stock exchange or is bought by another company.
[33] http://nationalchamber.lk/

business. Promoting trade is one of its major functions. Given Sri Lankan's modest focus on intellectual property and innovation up to recent times, the Chamber's focus on these areas has also been modest.

The National Enterprise Development Authority (NEDA)[34] - *NEDA* is a statutory body whose mission is to create a dynamic and sustainable, international competitive enterprise sector for Sri Lanka. One of its important projects has been "Developing Sri Lanka's SME Sector," a 10 year project funded by the German Federal Ministry for Economic Cooperation and Development. One of that project's major activities was supporting microfinance and a Technology Transfer Fund to benefit small scale entrepreneurs (see section 3.8).

There are no science or technology parks in Sri Lanka. However, SLINTEC is located on a campus on the outskirts of Colombo that it aims to nurture as a desirable location for other research organizations and technology based companies to locate, so that over time the campus will evolve into a cluster, and a technology park.

Technology and Innovation Support Centres - WIPO has launched a project to establish and develop Technology and Innovation Support Centers (TISCs) in Sri Lanka with the National Intellectual Property Office of Sri Lanka (NIPO) acting as the focal point. Its objectives include improving the intensity and quality of (technical) innovation in the country by raising awareness of patent and scientific and technical databases among inventors in Sri Lanka and providing state of the art search services. Two training seminars for TISC staff and resource persons in collaboration with NIPO to build skills in state of the art and patentability search have been carried out. TISCs are expected to be hosted in universities, research institutes, government departments and other locations throughout the country.[35]

These centers are expected to provide the following services:

1. Provide access to online patent resources, scientific and technical literature, and other intellectual property related publications.
2. Assist users undertake patent searches and retrieve other technology related information.
3. Provide training in the use of these resources.
4. Undertake patent searching services.
5. Provide information on intellectual property laws.
6. Provide information on intellectual property management, strategy, commercialization and marketing.

By doing so, TISCs expect to contribute to:

[34] http://www.neda.lk/index.php/en

[35] TISCs are expected to be hosted at the following institutions: Eastern University, Kotalawala Defence University, Rajarata University, University of Colombo, University of Jaffna, University of Kelaniya, University of Moratuwa, University of Peradeniya, University of Ruhuna, University of Sabaragamuwa, University of Sri Jayawardhanapura, University of Uva, University of Vocational Technology, University of Wayamba, Ministry of Technology and Research, IP Information Center, Vidatha Centres, Coordinating Secretariat for Science, Technology and Innovation (COSTI), Industrial Technology Institute (ITI), National Engineering Research and Development Center (NERD), National Science Foundation (NSF), Sri Lanka Institute of Nanotechnology (SLINTEC), Sri Lanka Inventor's Commission (SLIC)

1. Raising awareness of intellectual property by embedding patent documentation into regular research and development activities;
2. Increasing the efficiency of the innovation process by helping innovators and investors (such as government agencies) avoid allocating resources to "reinventing the wheel"; and
3. Reinforcing linkages between research and application by establishing networks between different types of TISC host institutions and creating relationships between for example, universities and research organizations on the one hand, and industry partners on the other.

The Sri Lanka Inventors Commission (SLIC)[36] – The SLIC is a statutory body. Its mission is to be a catalyst in bringing about innovation capability for the country. The Commission undertakes many diverse activities to promote and foster innovation in Sri Lanka including:

- Undertaking workshops, training, symposiums and exhibitions.
- Launching i-KIDS in 2014, which is a program that aims to improve school children's innovative thinking and creativity, by giving them activities that challenge their curiosity, powers of observation, and thinking abilities.
- Nurturing Young Inventors Clubs in schools.
- Putting inventors into contact with companies that may need their assistance.
- Encouraging and assisting Sri Lankan inventors to attend international innovation competitions.
- Holding an annual National Inventors Exhibition at which awards and prizes are made.

The Sri Lanka Inventors Commission is a champion for innovation in Sri Lanka, and has an impressive list of activities to reward current innovation, and importantly to foster and nurture future innovation.

3.6 COOPERATION BETWEEN RESEARCH AND INDUSTRY

There is evidence of pockets of very intimate engagement between research organizations and industry in Sri Lanka. Research Institutes in Sri Lanka that are funded by industry levies, including for example the Tea Research Institute, Rubber Research Institute, and Coconut Research Institute, not unexpectedly, have a very intimate relationship with the industry sectors that support them. They report that they engage with companies in their industry sectors to develop research priorities, and to plan and undertake research projects.

SLINTEC is an exceptional example of an organization specifically set up on the premise of intimate engagement between researchers and industry. It was formed in 2008 as a for-profit company, with the aim of undertaking applied, commercially focused, industrially relevant research. Initially five Sri Lankan companies joined as shareholders, with each contributing financial capital for the company's research and other operations. Between them, these Sri Lankan companies own 50% of SLINTEC's issued shares, and Sri Lankan government owns the remaining 50%. Sri Lankan Government also contributed funding for the building of

[36] http://www.slic.gov.lk/web/

SLINTEC's facility, and the purchase of research equipment. Since its formation, a sixth company has joined as a shareholder in SLINTEC.

SLINTEC employs 36 scientists and six engineers. SLINTEC's Board is composed of representatives of its corporate shareholders, as well as of Sri Lankan government. The casting vote however is held by a chairman appointed by one of the corporate shareholders. Until 2011, SLINTEC focused upon research projects that were brought to SLINTEC by its corporate shareholders. Since then, SLINTEC has expanded its projects to include projects of interest to companies that are not shareholders.

The University of Moratuwa has had exceptional success in engagement with industry. It reports having six research centers which are wholly funded by industry. These are:

- Dialog-UoM Mobile Communication Research Laboratory
- DSI-UoM Rubber Production and Process Development Incubator
- High Performance Computing Laboratory
- Premium International-UoM Research Laboratory for Biomedical Technologies
- UoM-Cargills Food Process Development Incubator
- Zone 24x7-UoM Electronic Systems Research Laboratory

Being wholly funded by industry, they are principally engaged in undertaking industrially relevant applied research, in the field that is of interest to the company that funds the center. As part of its engagement with industry, to facilitate learning each other's needs and capabilities, each center holds bi-annual meetings with its industry stakeholders. These twice a year meetings facilitate the exchange of information and ideas. At these meetings, possible research projects are considered, opportunities for student training are explored, guest lecturers from industry are arranged, and the relationships between the university and their industry partners are nurtured and reinforced.

The industry partners that support the research undertaken at these centers not only benefit from the industrially relevant research which they fund, but also recruit research staff from the research teams that they have funded, therefore providing employment opportunities as well.

The University of Colombo, in September 2013, set up the Colombo Science and Technology Cell, with funding that it received from the World Bank. It has been formed as a company limited by guarantee. It is intended to act as the interface between seven science faculties of the University of Colombo, and industry. Its focus is upon creating opportunities for research collaborations between the university and industry. It hopes over time to extend its operations to include the types of operations that a Technology Management Office (TMO) would undertake, including assessing intellectual property outcomes arising from the research undertaken at the university, and seeking out commercialization partners, including licensees, for those outcomes. Its World Bank funding will meet its budgetary needs for three years, after which it aims to be self-funding, relying mostly on income from research contracted by Sri Lankan industry. This is the second of this type of company established at the University of Colombo. A similar company was also formed to serve similar needs and objectives of the School of Computing.

The University of Peradeniya has an Engineering Design Centre within its Faculty of Engineering. It was established in 1993 with funding from the Asian Development Bank. It is now self-funding, and it describes itself as the University's commercial arm.[37] Its mission is to strengthen its research and development capabilities by forming partnerships with industry.

Another example of close engagement between a research organisation and industry is the Industrial Technology Institute, which reports that much of its work is undertaken at the request of industrial partners, which seek out the Institute to assist them find technical solutions to meet their needs.

Despite these examples which are pockets of excellence, it is understood that, in general, comparatively little engagement between research and industry actually takes place.

The tax deduction referred to in Section 3.7.2 below has been introduced to promote greater engagement between research and industry. The impact of this incentive will have to be seen.

3.7 FINANCIAL SUPPORT AND FUNDING AGENCIES

3.7.1 Research grants

Sri Lanka's National Science Foundation reports in its most recently available statistics[38] (2010) that Sri Lanka spent a total of Rs. 8,778.6 million (US$ 69.4 million) on research, which corresponded to 0.16% of Sri Lanka's GDP. It reports that

- 55.9% of that expenditure (Rs. 4,907.16 million) was from government
- 41% of that expenditure was from the business sector
- 2.72% of that expenditure was from foreign sources
- 0.45% of that expenditure was from other sources.

> In 2011, Malaysia recorded research expenditure of RM 9,422 million (US$ 2,923 million), which was a three fold increase over its 2006 expenditure. As a percentage of GDP, research expenditure in Malaysia in 2010 was 1.07%, still less than the world average.

Government research funding in Sri Lanka comes from a number of sources including:

- Ministry of Higher Education
- Ministry of Health
- Other Ministries
- University Grants Commission
- National Science Foundation
- National Research Council.

[37] http://www.pdn.ac.lk/eng/pages/Centers/edc/
[38] National Science Foundation. Sri Lanka Science, Technology & Innovation Statistical Handbook, 2010

Additionally, universities in Sri Lanka are expected to utilize 10% of their capital budget in undertaking research.

One of the visions expressed in the *Mahinda Chinthana* is that Sri Lanka increases its level of expenditure on research to 1% of its GDP[39]. One of the goals in the National Higher Education Strategic Management Plan of Sri Lanka, 2012-2015 Mid Term Plan is to increase the number of research projects that can contribute to national development[40]. In the Ministry of Finance and Planning's "Unstoppabale Sri Lanka 2020", released in 2013, it reported that research expenditure increased from Rs 10.2 million in 2011 to Rs 11.1 million in 2012.

Recently the Ministry of Education jointly with the University Grants Commission launched a new Research Grant Scheme (RGS) which has the stated[41] purpose of assessing grant applications on a competitive basis to fund basic, applied and adaptive research relevant to regional and national development. The first grants were made in 2013, when four grants were awarded.

The stated[42] aims of the scheme are to promote:
1. High impact innovative research.
2. Commercialization of research findings of utility value.
3. Funding postgraduate study, particularly PhDs.
4. Multi-disciplinary research.
5. Inter-institutional and international cooperation and collaboration.
6. Publications in peer reviewed journals.
7. Capacity building.

More recently the University Grants Commission launched a new Start-Up Research Support Programme (SRSP). It also has the stated[43] purpose of assessing grant applications on a competitive basis to fund basic, applied and adaptive research relevant to the regional and national development. It also has the same stated[44] aims. The first grants under this scheme are understood to be made in 2014.

For some years the University Grants Commission has administered a Postgraduate Research Grants Scheme. The number of grants awarded each year appears to be modest.

From the business sector, a major source of funding are industry levies paid by businesses in specific industries, with those levies providing funding for research institutes undertaking research exclusively in the corresponding industry sector. For example, levies paid by businesses in the tea, rubber, and coconut industries are directed to the Tea Research Institute, Rubber Research Institute, and Coconut Research Institute, respectively.

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[41] http://www.ugc.ac.lk/en/dric/research-grants.html
[42] http://www.ugc.ac.lk/en/dric/research-grants/1258-innovative-research-grants.html
[43] http://www.ugc.ac.lk/en/dric/research-grants/1361-preamble.html
[44] http://www.ugc.ac.lk/en/dric/research-grants/1362-aims-of-the-grant-scheme.html

3.7.2 Fiscal incentives

The Sri Lankan government has introduced a new tax deduction for contracted research and development expenditure. The deduction applies only when the expenditure is contracted to a research institution, and it applies for expenditure incurred from 1 April 2014. The tax deduction rate is 300% when research is contracted by a company to a university or a research institute, which means that income can be offset by three times the amount of expenditure actually incurred.

Fiscal incentives such as these are not uncommon and operate in many countries. They result in the true cost of research and development being lessened, since indirectly government is subsidizing the research in the form of tax foregone which would otherwise have been collected

The Sri Lankan Government seeks to foster and nurture a significant increase in the level of research activity in Sri Lanka. It wants universities to undertake more research, and to use 10% of its capital budget to do so.[45] It also wants to increase funding for research to 1% of its GDP.[46] In a climate where reportedly researchers have traditionally focused on teaching, with research being regarded a lesser priority, in 2011 the Government introduced a 25% salary bonus to researchers, which was earned if they undertook research that was ultimately published.[47] To be eligible for the bonus, researchers must submit a research proposal to the university's Research Management Committee and must undertake the research. To be able to claim the last instalment of the salary bonus, the researcher must:

1. publish the research findings in an internationally or nationally accepted journal, or
2. submit the paper to a symposium, or
3. seek a patent and license the patent.[48]

In the 2014 budget, the salary bonus was increased to 35%.

[45] National Higher Education Strategic Management Plan of Sri Lanka, 2012-2015 Mid Term Plan, Goal 6, Objective 1 page 15
[46] *Mahinda Chinthana* (Mahinda Vision) His Excellency Mahinda Rajapaksa, President of the Democratic Socialist Republic of Sri Lanka, 2005, p67
[47] Ministry of Finance and Planning, Department of Management Services, Management Services Circular No 02/2014
[48] Ministry of Finance and Planning, Department of Management Services, Management Services Circular No 02/2014

3.8 FOREIGN PROJECT SUPPORT

Sri Lanka is the recipient of foreign aid in a number of science, technology and innovation related areas. The following paragraphs describe just a few of these funded projects.

In 2012 the University of Colombo was awarded a World Bank grant to set up its Colombo Science and Technology Cell, a company which acts as an interface between the University of Colombo, and industry. A similar cell funded by the Asian Development Bank, called the Engineering Design Centre was set up at the University of Peradeniya.

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH continues to have a long term project in Sri Lanka funded by the German Federal Ministry for Economic Cooperation and Development. The Project, "Developing Sri Lanka's SME Sector," commenced in 2006 and is to continue until 2016. One of the project's completed activities was to support microfinance in Sri Lanka to benefit small scale entrepreneurs and small scale businesses, particularly in rural areas. A current activity is to strengthen SME's access to and investment in new technologies. One way that is being explored to do that is the establishment of a Technology Transfer Fund that will focus on small enterprises, and provide technical support for enterprises in less developed regions.[49]

Sri Lanka's Plant Genetic Resources Centre collects, introduces, conserves, and conducts research upon plant genetic resources, including seeds, in Sri Lanka. It was set up with grant funds from the Japan International Cooperation Agency.[50]

[49] http://www.giz.de/en/worldwide/23514.html
[50] http://www.agridept.gov.lk/index.php/en/institutes/382

CHAPTER 4 – INTELLECTUAL PROPERTY SYSTEM

4.1 INTELLECTUAL PROPERTY LAWS

The Intellectual Property Act, No. 36 of 2003, deals with

- Copyright,
- Industrial Designs,
- Patents,
- Marks and Trade Names,
- Layout Designs and Integrated Circuits,
- Unfair Competition and Undisclosed Information, and
- Geographical Indications.

Generally, it deals with these subjects in a manner that meets Sri Lanka's international treaty obligations on each subject (other than in relation to confidential information where there is no treaty). However, neither the Intellectual Property Act 2003 nor any other law in Sri Lanka deals with:

- plant breeders' rights, or
- utility model patents.

Sri Lanka is a member[51] of the Convention Establishing the World Intellectual Property Organization *(*WIPO) and a contracting party to the Berne Convention for the Protection of Literary and Artistic Works, Madrid Agreement for the Repression of False and Deceptive Indications of Source on Goods, Nairobi Treaty on the Protection of the Olympic Symbol, Paris Convention for the Protection of Industrial Property, Patent Cooperation Treaty and the Trademark Law Treaty. It has not yet acceded to the Madrid Agreement Concerning the International Registration of Marks and the Protocol Relating to the Madrid Agreement Concerning the International Registration of Marks nor the International Union for the Protection of New Varieties of Plants (UPOV).

[51] http://www.wipo.int/treaties/en/

4.2 INTELLECTUAL PROPERTY ADMINISTRATION

The National Intellectual Property Office (NIPO) of Sri Lanka is the office responsible for patent, trade mark, and industrial design applications. According to NIPO's web site,[52] the numbers of patent applications and patent registrations by residents and non-residents is as shown below.

Year	Applications			Registrations		
	Resident	Non Resident	Total	Resident	Non Resident	Total
1995	75	114	189	64	95	159
1996	50	114	164	98	107	205
1997	81	193	274	65	96	161
1998	54	158	212	44	97	141
1999	119	248	367	78	101	179
2000	71	250	321	59	169	228
2001	120	236	356	71	109	175
2002	123	202	325	59	54	113
2003	95	189	284	63	52	115
2004	120	195	315	103	85	188
2005	149	211	360	64	116	180
2006	153	270	423	68	69	137
2007	151	279	430	54	37	91
2008	209	241	450	89	70	159
2009	202	200	402	11	254	265
2010	225	235	460	220	284	504
2011	194	235	429	45	227	272
2012	unavailable		539	unavailable		126
2013	328	188	516	71	165	236

NIPO employs approximately 60 staff, almost half of which are engaged in the trade mark area. Only 6 members of staff are engaged in the patent area, and of those, the number of examiners ranges at different times from two to three. NIPO also engages in public awareness and education programs to make the community and enterprises more aware of intellectual property and its role in business.

[52] http://www.nipo.gov.lk/satistic.htm

CHAPTER 5 - SUMMARY OF DISCUSSIONS WITH STAKEHOLDERS

5.1 POLICIES AND THEIR IMPLEMENTATION

Stakeholders recognized that an innovation system has many components, and that they needed to work together, supporting and complementing each other's efforts to foster and nurture an innovation eco-system. However, many were not aware of the number of policies in existence, and when made aware, were skeptical about the ability to implement that many policies. Policy direction in and of itself was appreciated but there was confusion as to the nature and content of the different policies and their respective objectives.

Stakeholders felt that Sri Lanka lacked a coordinated innovation system, and that its fragmented approach hindered the objective of establishing a system with its various components, efforts and policies working together, complementing each other's roles.

Mention was made of Sri Lanka's:

- 20 universities operating under four different Ministries
- 44 research institutes operating under 17 different Ministries
- Two Ministries each having a role in innovation, science and technology, namely the Ministry of Industry and Commerce and the Ministry of Technology and Research as well as a Senior Minister of Scientific Affairs.
- at least three Ministries having a role in research in universities, namely the Ministry of Higher Education, the Ministry of Technology and Research, and the Ministry of Health.

Stakeholders recognized that the absence of a coordinated approach hindered the common objective that they all shared, which was to foster innovation in the nation. They felt that a nationally coordinated approach to innovation was needed. Such an approach would:

- set common objectives across Ministries and government agencies
- set pathways and mechanisms to help achieve those objectives
- standardize approaches on critical issues
- coordinate efforts so that efforts were not duplicated, but worked in a complementary way
- rationalize some efforts, such as focusing particular responsibilities within particular Ministries, rather than responsibilities being shared inefficiently across a number of Ministries

As is urged by Asanga Abeyagoonesekera, the Director of the Lakshman Kadirgamar Institute, Sri Lanka needs to develop a "National Roadmap for Innovation."[53]

[53] Abeyagoonesekera A, welcome address at the Lakshman Kadirgamar Institute's seminar "Unleash your Mind for Tomorrow: Spurring the Growth of Innovation in Sri Lanka" 25 November 2013 http://www.kadirgamarinstitute.lk/media/press_release/PRESS%20RELEASE%20-%20Sri%20Lanka%20needs%20%20a%20National%20Roadmap%20for%20Innovation%20says%20Director%20Abeyagoonesekera.pdf

5.2 LEGAL FRAMEWORK

A number of stakeholders highlighted the absence of legislation in Sri Lanka that protected new plant varieties. They reported that the absence of laws protecting new plant varieties resulted in the absence of incentives and encouragement in Sri Lanka to develop new plant varieties, and accordingly little investment was made to develop new varieties in Sri Lanka. It is noted however that legislation to protect new plant varieties has been drafted and is waiting to be passed. Section 6.2 discusses this in more detail.

5.3 RESEARCH BASE

5.3.1 Declining interest in science

Stakeholders reflected that the number of scientific researchers was in decline as was interest in science amongst school going children. As a result, Sri Lanka will be greatly hindered in its ability to have science and technology contribute to the economic development of the country. According to stakeholders many factors were responsible for the low numbers of researchers. Amongst them:

- University academics feel that teaching is priority, with research and publications being a secondary objective.
- The teaching load is such that there is no time to devote to research and publication.
- The funding for research is inadequate.
- Laboratories and research equipment to enable research to be undertaken is inadequate.
- Enrolments in science and technology disciplines are in decline.
- Migration of researchers to other countries.

Stakeholders had much anecdotal evidence supporting their observations. For example, researchers who left Sri Lanka to find employment elsewhere returning home were not able to find suitable employment were compelled to leave Sri Lanka again to a country where employment as a researcher was available. “Sri Lanka exports brains” one stakeholder observed. That Sri Lankans have been successful as researchers in other countries supports the view that Sri Lanka’s higher education system is world class and produces world class researchers. But disappointingly, Sri Lanka is not realizing the full benefit of these researchers, which benefit continues to be realized by other countries.

Without a skilled and dynamic research workforce, stakeholders observed, the research and development needs of Sri Lanka’s industry are being met, not by researchers in Sri Lanka, but by researchers in India, Singapore, and other countries. Further, it was reported, that there is a perception on the part of Sri Lankan industry, that Sri Lanka lacked the research capability that it needed, so it had little choice but to seek to have its research needs met in other countries.

Stakeholders commented that just as there are not enough researchers in Sri Lanka, there is also insufficient investment in research.

Referring to the salary bonus that was increased to 35% in the 2014 budget, some stakeholders suggested that this salary bonus was earned by almost all researchers, so that it

operated like, and was regarded as, part of a researcher's remuneration, rather than truly operating as an incentive for researchers. Further, they indicated that the emphasis with respect to satisfying the requirements is upon the publication of a paper, rather than to seek a patent and to license it.

Referring to the direction to Universities to apply 10% of their capital budgets to undertake research, stakeholders noted that as it is research that is largely uncoordinated and unmanaged, this direction results in research being pursued that may not necessarily be the most advantageous for Sri Lanka. Such research tended to be curiosity driven rather than industrially required, not in priority areas and that had already been published or patented.

Some stakeholders expressed doubt that a redirection of expenditure in this way from capital purposes to research will be sustainable. Some stakeholders also expressed doubt that universities are able to comply with this 10% requirement at all. It is important that there be greater investment into research in Sri Lanka, but it needs to be sustainable, stakeholders noted.

Stakeholders equally lamented the decline of science and engineering graduates from Sri Lankan universities, and were concerned about the impact that it would have in future years upon Sri Lanka's capacity to innovate, and what that would imply for the country as a whole. The next generation of innovators, intellectual property generators and technology entrepreneurs, are today's school children, whose scientific curiosity and inquisitiveness need to be piqued.

Amongst the steps to take to address this, stakeholders reflected, was to increase the teaching of science in schools. Tomorrow's scientists being today's school students, steps to increase the interest of school children in science would most likely have an impact on university science enrolments. Those efforts alone however would not be enough, stakeholders said, as reportedly less than 10% of schools have school science laboratories, and the ability to teach science.[54]

5.3.2 Curiosity driven, demand driven, fundamental and applied research.

A number of stakeholders commented that research in Sri Lanka needs to have a greater emphasis upon demand driven and applied research. The National Science Foundation reported that 70% of its grants funding is directed to applied research, with the remainder being directed to fundamental research.[55] "Unstoppable Sri Lanka 2020" referred to the prioritization of research that is development oriented.[56]

Sri Lanka's Institute of Fundamental Studies reported that it has historically focused upon fundamental research, but at the urging of its Chairman of the Board of Governors, His

[54] In "Science, Technology and Innovation Strategy for Sri Lanka 2011-2015," Ministry of Technology and Research, only 678 out of 9000 schools have the facilities to teach science. See page 65

[55] The newly established National Research Council is understood to take over the funding of fundamental research in the future

[56] "Unstoppable Sri Lanka 2020," Public Investment Strategy 2014-2016. Ministry of Finance and Planning Page 172

Excellency Mahinda Rajapaksa, the President of Sri Lanka, it has commenced to focus more and more on applied research. Universities undertake, it appears, comparatively little research, and the research that does take place is mostly curiosity driven.

5.3.3 Procurement and administrative impediments to research activity

A number of stakeholders remarked upon the delays that their research projects experienced as a result of delays in procurement and administrative processes.

Examples included:

- Delays in projects arising from procurement policies requiring a competitive tender process for the relatively small expenditure of Rs 5,000.
- Obstacles in incurring travel expenditure to attend a meeting with an industry partner putting at risk possible collaboration.
- Delays of up to six months to import chemicals in small quantities that were required for a research project, given the need for an import clearance from the relevant Ministry.
- Delays of up to six months in the signing of a Confidentiality Agreement with an industry partner, which is normally an uncontroversial document to facilitate discussions, again putting at risk possible collaboration.

There appeared to be a strong sentiment among Sri Lanka's research community that current procurement policies impeded research.[57]

In 2014 the Coordinating Secretariat for Science, Technology and Innovation undertook a survey of researchers on the issue and it reported that most respondents felt that:

- There was an inconsistent flow of research funding.
- Procedural delays hindered the expenditure of research funding that had already been received.
- Difficulties were encountered when seeking to maintain or repair research equipment.
- Central facilities for high technology instruments, testing facilities and a service centre were unavailable.
- There were procedural delays in obtaining approvals and following national procurement guidelines
- There were inefficient and complicated procurement procedures.[58]

[57] http://www.ft.lk/2014/04/10/procuring-our-way-out-of-existence/
[58] Analysis of Issues Existing in the National Research System in Sri Lanka, Coordinating Secretariat for Science, Technology and Innovation, 2014

5.3.4 Management of research output

The following are some examples of situations reported by stakeholders which illustrate the problems that could arise in the absence of systems in place to manage research output.

1. In negotiating a research collaboration agreement with an overseas university, it fell upon the researcher to identify the issues in the agreement, assess them, and find solutions to issues which he felt ill equipped to do. He had no access to a commercial adviser or to a legal adviser. The length of time it took to finalize the agreement, mostly as a result of the researcher being unable to obtain assistance, and feeling helpless in the process, resulted in frustrating the overseas collaborator and failing to protect the interests of the Sri Lankan research organization.
2. A research organization took six months to sign a Confidentiality Agreement. A Confidentiality Agreement is intended to be a short straight forward document, entered into promptly to facilitate confidential discussions about research and commercialization opportunities. An overseas collaborator would be deterred from continuing to collaborate with a partner that lacked promptness in relation to such a non-contentious matter.
3. A university that sought to participate in a commercialization opportunity which involved holding shares in a company needed to obtain the approval of Cabinet to do so. The need for Cabinet approval does not seem to arise from any provision in the Universities Act. Rather, it is understood that the Ministry of Finance's policies that mandate that universities not apply their funding for any profit making purpose, operate or are interpreted so broadly that even the participation in the formation of a technology start-up company required the approval of Cabinet.
4. The practice of granting non-exclusive licenses to SMEs with no appreciation of the advantages of other options such as granting a single exclusive license, both in terms of its products reaching and benefitting the greatest number of people but as well having the prospect of significantly greater economic benefits.
5. Patents sought and applied for by individual researchers employed in institutions in the mistaken belief that the researcher owned the intellectual property, when in fact, the intellectual property having been created in the course of employment, was owned by the researcher's employer. Reportedly, the (research organization) employer was aware of the application, and supported it, indicating that the employer itself did not understand its rights of ownership to the patent.

The mission of universities

Some stakeholders questioned whether universities had the power to commercialize intellectual property. Amongst the views expressed is that unless the Universities Act specifically expresses a power to commercialize, Sri Lankan universities under that Act do not have the power to do so.

Ownership of the intellectual property in research output

In the United States, prior to 1980, ownership of intellectual property arising from federally funded research vested in the United States Government. The Bayh Dole Act of 1980 changed this and vested the ownership of intellectual property arising from research funded by the United States Government, in the university or research institute that generated that intellectual property. This resulted in an explosion in commercialization activity, including the formation of technology management offices.

In turn, this was a catalyst in many other countries that had intellectual property arising from government research funds vesting in government, to pass their own laws that followed the Bayh Dole example enabling universities to set up technology management offices and pursue the commercialization of their intellectual property

Even amongst those countries that had no need for legislation like the Bayh Dole Act, since the ownership of intellectual property was already vested in the recipients of grant funding, the explosion in commercialization activity amongst research organizations in the United States was a catalyst for commercially idle research organizations elsewhere in the world to set up technology management offices and to pursue the commercialization objective.

The result has been that since 1980 there has been an exponential growth in commercialization activity amongst universities and research institutes throughout the world, and the successful commercialization of numerous technologies. That in turn has resulted in social and economic benefits that would otherwise have not accrued to the universities and research institutes, nor to their countries.

Feedback from stakeholders indicates that this issue – who owns the intellectual property arising from research funded by government and government agencies - is presently dealt with in a fragmented way in Sri Lanka.

The National Science Foundation reports that its grant conditions vest the ownership of intellectual property arising from research it funds, in the grantee. The Ministries of Higher Education and Health report that the intellectual property arising from research they fund, vests in the Ministry itself. Nurturing an innovation system is hindered if policies amongst different Ministries and government agencies are not uniform and consistent, acting together to achieve the common objective.

Assignment of intellectual property

Some stakeholder feedback indicated that the Sri Lankan Government may be concerned that Sri Lankan research organizations may assign intellectual property created by them to a foreign assignee, and that by doing so the benefits of the intellectual property would be lost to Sri Lanka. That is a legitimate concern on the part of the Sri Lankan Government.

As a general rule, the assignment of intellectual property, whether to a foreigner or to a local should be regarded as the last commercialization option because most often it provides the lowest financial return, and it represents the loss of the potential for economic benefits such as

employment opportunities, an increase in the tax base, growth of Sri Lanka's manufacturing sector, export opportunities and foreign revenue opportunities.

It would not be unusual for a company (whether foreign or Sri Lankan) to expect the assignment of intellectual property created by a research organization. This is quite acceptable when it is contract research, but it is not normally acceptable otherwise. The preferred commercialization pathway is to license so that there are ongoing economic benefits. For Sri Lanka, the preferred licensee would be a Sri Lankan company that has the capability to exploit, and desirably, the capability to do so in a way that accrues the greatest economic benefit to Sri Lanka. But of course there will always be occasions where assignment of intellectual property will be necessary. For example, the intellectual property may be such that there is no capability in Sri Lanka for its exploitation, nor likely to be.

It is not possible to be prescriptive and to prohibit assignment altogether. There will always be exceptional occasions where the assignment of intellectual property is the only available strategy, or even the preferred strategy. These exceptional occasions should be few and far between.

5.4 BIO DIVERSE RESOURCES

The collection of bio diverse resources in Sri Lanka requires a permit issued by the Department of Forestry, or by the Department of Wildlife Conservation. Stakeholders have mentioned that these permits are issued on condition that the intellectual property arising from research undertaken upon bio diverse resources must be jointly owned by the Department of Forestry, and the permit holder. For example, if a Sri Lankan university is issued a permit, it is done on the condition that the intellectual property arising from the university's research based on that bio diverse resource, will be jointly owned by the university and the Department of Forestry.

Stakeholders reported that this requirement has had the consequence of deterring overseas collaborators from entering into partnerships with them, frustrating their research endeavors and their access to the experience, knowledge and funds of such overseas collaborators.

5.5 COOPERATION BETWEEN RESEARCH AND INDUSTRY

Despite the existence of excellent examples of engagement between research organizations and industry, stakeholders reported that such engagement was not the norm. They confirmed that the examples of engagement of SLINTEC, the University of Moratuwa, the Industrial Technology Institute, and the industry levy funded research institutes, were examples that represented only small pockets of engagement. Stakeholders reported that industry is largely unaware of the capability of research organizations, and research organizations are largely unaware of the research needs of industry.

They report that, as a result, there is little exploration by industry and by research organizations as to what they can do for each other. Stakeholders reported that industry often

sought solutions for their technical problems from research institutes outside the country without considering whether that capability existed in Sri Lanka.

A number of stakeholders made the observation that Sri Lanka was a nation of traders, that is exporters and importers, exporting what it had, and importing what it needed, and that it did not have a record of innovating and manufacturing to meet its domestic needs, nor for export. Along the same theme, remarks were made by some stakeholders that companies did not see the point of undertaking research and innovation. Sri Lanka's industry therefore has not been very much engaged in innovating and undertaking research and development.

Research institutes aligned with particular industry sectors such as the Tea Research Institute had for many years benefitted from industry levies which funded those research institutes. Stakeholders reported that currently only part of the levies were received by these institutes. Stakeholders in those industries understandably disagree with the current practice, and prefer that the whole of the levies raised be applied to fund the applicable research institute, as was once the case.

5.6 SKILLS DEVELOPMENT

Many stakeholders referred to the absence of patent drafting skills in Sri Lanka. Drafting patent claims is an important skill that needs to be available in Sri Lanka. Without patent applications being drawn with strong claims, patents that will ultimately be granted will lack the commercial robustness that will be needed for the patents to have their maximum value, and to be defendable.

The drafting of patent claims is a highly skilled and specialist task. For effective patent claims to be drafted, ideally, the drafter should have scientific skills in the field of science that the patent is in. It is very difficult for example, for a layperson to draw a patent specification in a field of science, without the scientific knowledge in the relevant field to do so. It is difficult therefore for a lawyer to draw complex patent specifications in a highly technical or scientific field, without qualifications and experiences in that field.

This does not necessarily mean that researchers are necessarily best placed to draft patent specifications. There are patent drafting skills that are learned, as well as patent drafting skills that accumulate with experience. The researcher that invented the invention that is sought to be protected by a patent is therefore not necessarily best placed to draft the best patent specification.

Ideally, patent drafting should be undertaken by scientists that are qualified in the field of science in which they are drafting, as well as having patent drafting qualifications and experience. In most countries therefore, patent attorneys have PhD qualifications in a field of science, as well as postgraduate qualifications in patent law, and over time, accumulate patent drafting skills and experience. Sri Lanka will over time evolve to similarly having specialist patent lawyers with qualifications in both a field of science, and law, and experience in both areas. But in the meantime, Sri Lanka needs to address its lack of patent drafting skills.

CHAPTER 6 – CONCLUSIONS

6.1 POLICY FRAMEWORK

Sri Lanka has released a number of aspirational policies seeking to help innovation, science and technology flourish. It is extremely positive for the innovation system of Sri Lanka when His Excellency the President expressed through the Mahinda Chinthana the need to innovate and the steps that need to be taken to ensure the necessary environment for innovation to flourish. This level of political commitment bodes well for Sri Lanka.

An excellent strategy was formulated in 2010: "Science Technology and Innovation – Strategy for Sri Lanka 2011-2015" by the Ministry of Technology and Research. Building on that, the Ministry of Higher Education directed parts of its "National Higher Education Strategic Management Plan of Sri Lanka, 2012-2015 Mid Term Plan" to focus on science and technology. Also building on that was the Ministry of Finance and Planning "Unstoppable Sri Lanka 2020", Public Investment Strategy 2014-2016 and most recently we have the Investment Framework for Research and Development, 2015–2020.

But the implementation of these aspirational policies and strategies has only been partly achieved. Some areas have been wholly neglected. Other areas have been implemented to only a limited extent. There is a lot still to be done. The aspirations are well intentioned, but it appears that what has been lacking is a good implementation plan, prepared with realistic goals in mind that are capable of being achieved, and resourced for achievement.

In each country there are competing needs for the financial support that Government is able to allocate. A difficult task is seeking to balance financial support to immediate and short term needs such as health, education, agriculture, and long term needs, such as economic development. The financial support of research and development and technology transfer is a long term need, but investment into it can help alleviate immediate and short term needs as well as needs of the future.

Developing countries like Sri Lanka undertake the balancing task referred to with greater difficulty than other countries. Clearly, more resources need to be invested in innovation, science and technology if it is to contribute to Sri Lanka's economic development, and the improvement of the lives of Sri Lanka's people. Marginal or incremental increases in resources are unlikely to have an impact. A large, significant investment in innovation, science and technology, with comparable follow on investments in succeeding years however, will make a difference, and will have an immediate impact. It could also be the catalyst to provoke cultural change to create an innovation and commercialization culture.

The key remains a real, concerted and deliberate effort to implement the various policies that have been declared. Aspirational goals are not so easy to implement. Goals need to be resourced, and unless resourced, cannot be implemented.

A National Innovation Policy, including its implementation plan therefore needs to focus not just on what ought to be done, but on what can be done with the resources available. They also need to be formulated in consultation with the Ministry of Finance and Planning to ensure that financial resources for the implementation of the national policy are committed.

6.2 INTELLECTUAL PROPERTY SYSTEM

6.2.1 Plant variety rights

Sri Lanka does not at present have legislation dealing with plant variety rights. A plant variety right is an intellectual property right that is granted to a breeder of a new variety of plant. It is a right than confers on the breeder the exclusive rights over the new variety's propagating material (including seed, cuttings and tissue culture) and harvested material (including fruit and cut flowers). It offers protection not just in relation to ornamental plants, but as well to crops for human or animal consumption.

Cross-breeding and developing a new variety, that for example is resistant to disease, or grows more vigorously, or has some attribute that makes it particularly suitable to grow in particular climatic conditions, is an expensive and resource intensive process. Plant variety rights exist to provide incentives, and to encourage plant breeders to make the investment of resources to developing new plant varieties.

The advantages to Sri Lanka of legislating a plant variety right include:

- developing plant varieties that will provide a greater yield
- developing plant varieties suitable for Sri Lanka's climatic and other growing conditions
- more efficient agricultural industries
- import replacement.

Reportedly, farmers in Sri Lanka must import seed, but this foreign seed is not necessarily adapted to local growing conditions. It means that agricultural land in Sri Lanka is being used less efficiently than it could be, with less economic benefits than that which could be achieved.

Given that Sri Lanka's arable land is limited, developing plant varieties that produce greater yields, that are more appropriate for Sri Lanka's growing conditions, and that make more efficient use of the limited land and other resources, have the prospect of accruing significant benefits to Sri Lanka.

There is much scope for Sri Lanka's agricultural industries to be improved, be made more efficient, and to benefit from innovation which presently does not appear to be taking place to the extent to which it could. The introduction of plant variety protection legislation would encourage plant breeders to invest in developing new plant varieties and improving existing varieties.

It is understood that legislation introducing plant variety protection in Sri Lanka has been prepared, and is awaiting passage.

6.2.2 Utility models[59]

Utility models (also known as petty patents), when compared to standard patents:

- have less stringent registrability requirements, such as a lower standard for inventive steps
- are less expensive to obtain
- are granted in a considerably faster time frame (given the less stringent registrability requirements)
- have a duration shorter than a standard patent (20 years from the application date), which in many countries ranges from 6 to 12 years.

Therefore, utility models can be of greater appeal to micro and small and medium enterprises, which otherwise might have been deterred from the patent system.

In Sri Lanka, as in many parts of the world, small and medium enterprises employ 70% of the workforce, make up 90% of all businesses, and therefore make up a large proportion of the industrial sector's 26% contribution to Sri Lanka's GDP[60] The contribution that SMEs can play to innovation and economic development is recognized. So, rather than SMEs being deterred from participating in the patent system, their participation should be facilitated. A utility model system would facilitate that participation.

Sri Lanka does not presently make provision in its intellectual property laws for utility models. This leaves innovators with a difficult choice to make between two options.

1. apply for a standard patent, which will be a more expensive process, take significantly longer to obtain and would be subject to more stringent registrability requirements, or
2. maintain the innovation as a trade secret, where it cannot enjoy the benefits of patent protection, and will have the risk of loss of value if the trade secret should enter the public domain.

This difficult choice sometimes deters innovators, particularly micro and small and medium enterprises from innovating at all.

Another result of having a utility model system is that it introduces users to the patent system, and as their enterprises grow, and as they become more familiar and accustomed to the patent system, and knowledgeable about its benefits, users can "graduate" from seeking utility models to seeking standard patents.

Many countries do not have a utility model system, including the United States and the United Kingdom. There are, however, numerous significant countries that do have a utility model patent system[61] including the larger European countries (France, Germany, Italy, Spain etc), and three of the four BRIC countries (Brazil, Russia and China).

Given the 10 year Project "Developing Sri Lanka's SME Sector" funded by the German Federal Ministry for Economic Cooperation and Development (see 3.8), and its focus upon

[59] http://www.wipo.int/sme/en/ip_business/utility_models/utility_models.htm
[60] Wickremasinghe S, The Status of SMEs in Sri Lanka and promotion of their innovation output through networking of S&T institutions, Tech Monitor, July-August 2011, p13
[61] http://www.wipo.int/sme/en/ip_business/utility_models/where.htm

innovation by micro and small and medium enterprises, introducing a utility model system in Sri Lanka would complement that project and help it achieve its objectives.

6.2.3 Madrid Protocol

As indicated above, Sri Lanka is not yet a member of the Madrid Union. The Madrid Protocol provides important advantages in the process of seeking to globally register and protect a trademark. If not using the Madrid System, an applicant for a registered trade mark needs to make separate applications for the trademark in each country that it seeks to register the trade mark. This is a costly process. Through the Madrid Protocol an application to register a trademark can be made as a single application to the International Bureau of the World Intellectual Property Organization (WIPO), filed through the intermediary of the Office of Origin (to which the applicant is related in terms of nationality, domicile or business activity; this feature contributes to making the Protocol user-friendly). Once the trademark is registered in the international register maintained by WIPO, the trademark takes effect in all the Contracting Parties to the Protocol designated by the applicant (except for any that may object). The Madrid Protocol therefore provides a more efficient and less costly process to register trademarks globally.

Nevertheless, accession to the Madrid Protocol should be effected only when compliance of the Sri Lanka national law to the Madrid System legal framework is ascertained, and once readiness of the Sri Lankan public IP infrastructure (IP Office and other staff, IT systems, processes and procedures, and other related resources) is found to be in a condition to provide an efficient framework for the correct functioning of the Protocol in Sri Lanka. This compliance and readiness should be determined through a close cooperation between the competent Sri Lankan authorities and WIPO.

6.2.4 Disclosure of origin of genetic resources in patent applications

The compulsory disclosure in a patent application of the country of origin of a genetic resource when it is the subject of patent claims is a measure that has been introduced in a growing list of countries.[62] The failure to make disclosure can have important consequences, including in some countries, affecting the validity of a patent, disqualifying an applicant from obtaining a patent, or resulting in fines and penalties. There is a lack of an international treaty on the subject, and there is a lack of international harmonization on how it should be treated legislatively. In some countries, the issue is a highly contentious one.

Sri Lanka does not presently have laws dealing with the compulsory disclosure of the country of origin of a genetic resource when it is the subject of patent claims. But, being a country that is rich in bio diverse resources, it should consider joining the list of countries that do.

[62] Belgium, Bolivia, Brazil, China, Colombia, Costa Rica, Denmark, Ecuador, Egypt, India, Norway, Peru, South Africa, Sweden, Switzerland

6.3 RESEARCH BASE

6.3.1 Curiosity driven, demand driven, fundamental or applied research

If science and technology is to contribute to Sri Lanka's economic development, it will be important to concentrate research efforts upon that research that is most likely to contribute to that economic development. Research can be curiosity driven, demand driven, fundamental or applied. Curiosity driven research is research that is undertaken principally because of a researcher's curiosity to undertaken that research. Demand driven research is research undertaken at the instigation of a technology user that has identified a research need, such as where industry instigates the undertaking of the research. Fundamental research is research that focuses upon obtaining a greater understanding or knowledge of the fundamental aspects of a scientific area, but does not seek to produce a practical end result from the research. Applied research on the other hand is research that has as its objective achieving a practical end result from the research which can be useful, for example, to industry.

No single category of research is more important than any other category. Curiosity driven research, and fundamental research are the platform upon which all demand driven or applied research is built. Therefore, but for the curiosity driven research and fundamental research done today, there may be no demand driven or applied research able to be done tomorrow.

For science and technology to contribute to economic development, it needs to be demand driven research, and applied research as such research will have outcomes that are closer to industrial application. Curiosity driven or fundamental research, on the other hand, are by their nature, unlikely to have industrial application.

While curiosity driven and fundamental research must be done in Sri Lanka there is an urgent need for more demand driven and applied research, which will, in the short term, create opportunities for science and technology to contribute to Sri Lanka's economic development. Stakeholders reflected that it is this type of research that will be most beneficial to Sri Lanka in the most number of ways.

These comments apply not just to university research, but as well to research undertaken in Sri Lanka's 44 research institutes.

One way of implementing a balance between the different types of research is to have two very clear and distinct streams of research funding where one stream would be applied solely for basic or fundamental research and the other confined to applied research projects. Applied research projects would be ineligible for funding by the former and basic or fundamental research would be ineligible for funding under the latter. Both streams would select projects to be funded having regard to merit, in a competitive framework. Separating streams in this way would achieve a number of purposes:

1. It would signal a message of the importance of basic or fundamental research and of the separate and independent importance of applied, industrially relevant research.
2. Research projects that had previously been funded under the basic or fundamental research stream could, if the research progresses to an applied phase, continue to be funded under the applied, industrially relevant research stream.

3. Projects that are close to market readiness, which are often neglected because they are ineligible for public funding due to the proximity of market readiness, could be funded, instead of, as normally occurs, the project ceasing.

6.3.2 Type of applied research

In determining which type of applied research to focus on one criterion could be the time that it takes to reach commercialization readiness. Information technology for example, as a rule, has a very rapid time to commercialization readiness and to the point of economic impact. In other words, the time from conception, through research, development, to positive economic impact can be a very short duration, sometimes shorter than one year, but one to two years being more usual. Electronics also has a very rapid timeframe to commercialization readiness. Again, a period of one or two years, or shorter is not unusual.

Another field that has a rapid time to financial return is diagnostic products. Conception, through research, development, to commercialization readiness and financial return can be one to three years. As a rule, engineered products can have a similar timeframe of two to four years and agricultural biotechnology has a slightly longer timeframe of three to five years.

At the other extreme however, is the development of drugs and vaccines, where the timeframe from conception, through research, development, to commercialization readiness and economic impact can be as long as 10 to 15 years.

This is not to say that Sri Lanka should avoid drug development research. On the contrary, Sri Lanka having rich bio diverse resources has a responsibility to explore the contribution that those bio diverse resources can make to Sri Lanka's economic development, and as well to the improvement of health around the world.

But the time frame to commercialization readiness should clearly be considered an important factor in weighing up how to use research resources (such as funding), so as to achieve a desirable balance between research that has short, medium and long term prospects of contributing to Sri Lanka's economic improvement.

6.3.3 Areas of science

Ideally, no area of science should be neglected from research efforts. But given that Sri Lanka's research workforce is small, and even with concerted efforts to increase its size and therefore the quantity of research, it will remain small by international standards for some time to come, it is necessary to make choices on what should be priority research areas.

The Investment Framework for Research and Development, 2015-2020 has identified ten priority areas of research. Yet, even within those ten areas the research possibilities are endless and the Government will be challenged in determining:

- allocation of funding and resources amongst competing research priority areas and how those research priority areas rank as between themselves,
- ranking the merit of competing interventions within research priority areas,

- balancing curiosity driven research proposed by researchers, against the demand pull research proposed by industry and other users,
- balancing important fundamental research, and applied research which has greater prospect of realizing economic benefit,
- balancing of research in scientific areas that have short, medium, and long term commercialization readiness timeframes,
- deciding which research projects have the prospect of the greatest economic impact,
- deciding which research projects have the prospect of the greatest social benefit impact,
- balancing the support of research projects with economic impact against research projects with social benefit impact.

As challenging will be:

- identifying the criteria for making those decisions, and
- deciding upon the relative weight of that criteria.

These will be important and difficult decisions. It will also be important to identify areas of research where Sri Lanka is particularly well placed to realize benefits. One example is research in the field of graphite. Sri Lanka reputedly has the best graphite in the world, which it exports. But Sri Lanka is understood not to make any value added graphite based products, of which there are many. If these products were developed, and manufactured, Sri Lanka would participate in the value adding chain, which can help realize significant economic benefits including generating employment, increasing the tax base, and earning export revenue.

6.3.4 International collaboration

The benefits of international research collaboration are many, including the skills development that occurs when researchers collaborate with each other. International research collaborations would increase not just the skills of Sri Lanka's researchers, but would also increase their standing and reputation internationally. There are many Sri Lankan researchers that are working in other countries. They could be an untapped resource that could assist researchers in Sri Lanka to collaborate with research institutions in other countries.

6.4 MANAGING RESEARCH OUTPUT OF UNIVERSITIES AND PUBLIC RESEARCH ORGANIZATIONS

6.4.1 The mission of universities

Section 28(1) of the Universities Act of 1978 (the Act) establishes each university as a separate legal entity, with broad powers to acquire and dispose of property. It appears, therefore, to have power to enter into commercialization contracts by which it may, for example, license intellectual property. Nevertheless, it is of concern that there may be perceptions that universities have no power, and therefore no mandate to commercialize intellectual property. Desirably, something should be done to address these perceptions.

A reading of section 29 of the Act suggests that each university's major focus is upon teaching and education. Very little is said in the Act about research, and nothing at all is said about commercialization. If science and technology, through its universities, is expected to contribute to Sri Lanka's economic development, it is necessary for this to be aligned with the mission of universities. Teaching and education is only one of those missions. Research, and the benefits of that research reaching the community and benefitting the community also needs to clearly be included in the mission of universities.

One way of that mission being recorded is for the Act to be amended to specifically refer to the critical role that universities play in generating and commercializing intellectual property, for the benefit of the community as well as the economic improvement of Sri Lanka.

6.4.2 Ownership of Intellectual Property

If Sri Lanka is to experience economic development with a contribution from science and technology, it is critical that it equip its universities and research institutes with the ability to do so. International best practice is that the ownership of intellectual property arising from research undertaken from research funds granted by government needs to rest with the grantees of those funds.

Amongst the reasons for this international best practice are:

- Universities and research institutes as owners of intellectual property are best motivated to seek to commercialize to best advantage.
- Commercialization relies heavily upon the researchers that generated the intellectual property.
- Universities and research institutes being the recipients of the commercialization revenue that will accrue from successful commercialization, are the stakeholders with the greatest immediate motivation to try their hardest to succeed in commercialization.
- Universities and research institutes are better placed than government or government agencies to assess and take risk which is a necessary part of commercialization.
- As a general rule, companies are hesitant to deal with government and government agencies in commercialization transactions, because of a perception that government and government agencies are not able to assess and take on commercial risks.

The National Science Foundation presently adopts international best practice by having the ownership of intellectual property arising from research it funds vest in the grant recipient. However, it is understood that the Foundation, concerned about the poor commercialization performance of universities and research institutions in Sri Lanka, is considering departing from its current practice and adopting a policy that it will require that ownership of intellectual property arising from research that it funds to vest in the Foundation itself. While the Foundation is quite right to be concerned about the poor commercialization performance of universities and research institution in Sri Lanka, its contemplated response to that would be a regression and it is therefore urged not to depart from international best practice. Addressing its legitimate concern is still necessary however, and some suggestions in this respect are made below.

6.4.3 Technology Management Offices

A Technology Management Office (TMO) serves the critical role of bringing research outcomes from the lab to the market and, as a result, benefitting the community and the economy. It is the interface between researchers and industry, facilitating research collaborations, research alliances, and commercialization agreements. Without a TMO to undertake these tasks most good research remains just that, good research, without any benefit to the community, and without any economic benefits being realized.

Mahinda Chinthana states "New inventions patented by local universities and other institutions will be introduced to local entrepreneurs."[63] A TMO will assist the realization of this vision.

If Sri Lankan research outcomes are to benefit the community and realize economic benefits, it is critical that research organizations in Sri Lanka have access to a TMO. Such a TMO would ideally perform the following functions:

- Engage with industry.
- Secure industry funded research.
- Efficiently deal with research agreements, collaboration agreements, alliance agreements, license agreements, and other commercialization agreements.
- Identify protectable intellectual property.
- Proceed to protect the intellectual property.
- Commercialize intellectual property by, for example
    - utilization, that is facilitating the adoption of innovations by Sri Lankan industry,
    - licensing and/or
    - the formation of start-up companies.

The University of Moratuwa reports that it is presently in the course of establishing a TMO. It is understood that this will be the first TMO in Sri Lanka, when established.

The larger universities and research institutes in Sri Lanka should be able to establish their own TMOs. These may commence as only one or two person outfits, and grow over time as the quantity of research and the amount of research output increase.

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[63] *Mahinda Chinthana* (Mahinda's Vision) His Excellency Mahinda Rajapaksa, President of the Democratic Socialist Republic of Sri Lanka, 2005, p56

The smaller universities and research institutes in Sri Lanka may not be able to justify the expense of each of them maintaining a TMO. Consideration could be given to them jointly establishing a single TMO that serves the needs of all of them.

For example, a company could be formed, such as a not-for-profit company limited by guarantee, with each university supporting the TMO being a member of the company. The university members of the company would appoint the board members.

Amongst the challenges of such a centralized TMO would be

- how to properly service the needs of each university member, given that university members would be located throughout Sri Lanka,
- how to engage with industry on behalf of one specific university member, without other university members believing (whether with or without merit in the belief) that its own interests were being compromised or sacrificed,
- how to ensure that particular university members were not neglected.

To help overcome some of these challenges, the centralized TMO could operate a "hub and spoke model". In this model of a TMO structure:

- There is a central office ("the hub") where the major skills of the TMO reside, such as protecting intellectual property, negotiating agreements, engagement with industry, etc.
- There is also one person located at the campus of each university member ("the spokes"), on a full time basis, to:
    - be the local interface between the university and the TMO,
    - establish and maintain relationships with scientists at the university,
    - "scout" for technology transfer and commercialization opportunities at the university,
    - be the first point of contact for researchers at the university, and
    - be the first point of contact for engaging with local industry.

Funding a TMO will be a major consideration. The Government should consider providing financial support for the establishment of TMOs at each large university and research institute, and a single TMO for the smaller universities and research institutes collectively.

The staff of TMOs will need to climb a rapid learning curve and acquire many skills such as engaging with industry and protecting the university's or research institute's interests in commercial negotiations and doing so in a way that fairly balances the needs of industry partners as well. Rapidly climbing that learning curve would be assisted by training, but which would also be assisted by TMO staff having internships in TMOs in other countries. A TMO in another country could be receptive to an increase in its manpower, without charge, by hosting such internships. An internship of just six months can result in a TMO staff member being exposed to many TMO issues and practices so that the staff member will rapidly climb the learning curve. The advantages of internships as a learning opportunity as well as an opportunity to absorb the dynamics and operations of a TMO cannot be underestimated.

There are many questions to be considered in considering the setting up of a TMO including:

- What is the university's or research institute's mission? Does it align with the commercialization objective? Does that mission need to be revised?

- Does the commercialization objective have the sanction and support of the university's governing body and its executive?
- Do university policies operate to facilitate, or to hinder the commercialization objective? Do they need to be considered and amended? Is there a need for new policies?
- Is institutional change required? Does a "commercialization culture" need to be nurtured amongst researchers?
- Is there awareness amongst researchers of intellectual property, its identification, management and protection? Is there awareness amongst researchers of the commercialization objective, of its community and economic impact, and why it should be achieved?
- Does the university have the research infrastructure that it needs to carry out the research that it intends to do?

The following issues would also need to be considered with respect to the structure of a TMO:

- Should it be an office within the university or research institute, or should it be a separate company?
- If it is to be a company wholly owned by the university or research institute, what skills should be represented on its board, and from where should board members be drawn?
- Are there any advantages or disadvantages in having a university controlled board, or alternatively a Board most of whose members are independent?
- What skills and attributes should the TMO's chief executive officer or officer in charge have? Should this person be a researcher, or drawn from industry? Should their backgrounds include both academic as well as industry experience?
- What skills and attributes should the TMO's staff have? Should these staff be researchers, or drawn from industry?
- Should the TMO's staff be located in a central office, or decentralized amongst faculties and laboratories?

None of these questions have a single correct answer. All options can be correct, but careful consideration needs to be given to these options, and the factors that influence the choices to be made.

6.4.4 Intellectual Property Policies and Processes

For universities and research institutes to successfully identify, protect and commercialize intellectual property they need to have an Intellectual Property Policy, the whole policy and process infrastructure that supports those objectives, and the TMO's mission to achieve those objectives.

An Intellectual Property Policy, at a policy level – not implementation level, usually deals, in brief terms, with:

1. The ownership of intellectual property created by staff, students and visitors.
2. The objective that intellectual property be identified and assessed and if appropriate, protected and commercialized.
3. The ownership of copyright in scholarly papers, textbooks, artistic works etc.
4. The ownership of copyright in teaching materials.
5 The ownership of copyright in commissioned works.

6. The distribution of commercialization revenue, including the percentage to be shared between the creators of the intellectual property that has been commercialized.

But much more will be needed to support the technology transfer and commercialization objective. A policy and process infrastructure at a research organization, will need protocols, or standard operating procedures dealing with the implementation of:

1. The manner of disclosure of inventions and new intellectual property to the TMO.
2. The commercial assessment of new disclosures.
3. The criteria for deciding to proceed with applications for local and international patents.
4. The assignment of intellectual property from a student or visitor to the research organization (to ensure that it is not, and does not appear to be, tainted by duress or other grounds of challenge).
5. Dealing with visiting scholars.
6. Commercialization choices and options.
7. The distribution of commercialization revenue amongst inventors and creators of intellectual property, including dealing with what will be considered revenue, and what will not, what is and what is not an expense to be deducted from revenue before distribution, dealing with shares in a company, dealing with the continuation of entitlements after ending of employment, and after death, dealing with distributions to multiple inventors, and dealing with disputes, etc.

The University of Moratuwa is understood to be one of the few universities in Sri Lanka that has an Intellectual Property Policy and a Commercialization Policy.[64]

Every university and research organization in Sri Lanka should have an Intellectual Property Policy that as a minimum deals with the seven items referred to above. In some countries, a university or research organization, to be eligible to apply for research grants from government and government agencies, must have such a Policy. Where an applicant for a research grant in those countries does not have such a policy, its application for research funding is rejected.

[64] http://www.mrt.ac.lk/ipac/policies.html

6.5 ENCOURAGING COLLABORATION BETWEEN RESEARCH AND INDUSTRY AND WITHIN INDUSTRY

6.5.1 Research co-investment with Industry

Amongst Sri Lanka's present programs of funding research, there appears presently to be no program that funds research on the basis of co-investment between a public sector granting body, and an industry partner. Co-invested research funding has been a major way that many countries have encouraged university-industry linkages and collaboration. The advantages of doing so are many:

- Given the involvement of the industry partner, it is likely to be industrially relevant, and demand driven.
- Depending on the outcome of the research, there is a ready commercialization partner for the university.
- There is a higher expectation of the research outcomes making an economic contribution.

With co-investment in this way between a public research funding body and an industry partner, say a 50% contribution by each, a research program funding budget could fund twice as much research.

There is also the possibility of more long term advantages arising from such a research funding program, which are reported by countries that have implemented this model of research funding such as:

- A longer term relationship between the university and the company.
- Fostering greater engagement between universities and companies, with the prospect of more university linkages and collaboration.
- Fostering greater engagement by the company with other universities and other research organizations.

6.5.2 Innovation voucher

The absence of fiscal incentives has contributed to the low level of engagement between research organizations and industry. This has however changed, with a 300% tax deduction which has become available for companies that incur research and development expenditure that is contracted to a research institution. But much more could be done to increase the level of engagement between research organizations and industry.

An Innovation Voucher system is an initiative that encourages collaboration and engagement between research organizations and industry. It operates like a check, drawn by a government agency, entitling the holder of the voucher, a company, to use the "check" to pay for research services provided to the company, by a university or other research organization. The objective of the innovation voucher is to build links between industry and universities and research organizations. The voucher is for a relatively small amount of money, but the token amount of the innovation voucher grant has contributed to it having become a very successful initiative in many countries.

Country-Province-State	Voucher Amount
Alberta (Canada	$15,000
Austria	€5,000
Connecticut (USA)	$10,000
Czech Republic	Kč 75,000 (~ €3,000)
Ireland	€5,000
Lebanon	€10,000
Lithuania	Lt 10,000 (~ €3,000)
Singapore	$5,000
Victoria (Australia)	$25,000
United Kingdom	£5,000

6.6 BIODIVERSE RESOURCES

Sri Lanka is a country that is rich in bio diverse resources. This presents the following opportunities:

- Discover new compounds.
- Undertake worthwhile medical research.
- Undertake worthwhile research collaborations.
- Benefit economically from new compounds that are discovered.
- Secure non-financial benefits from collaborators, such as collaborating with pharmaceutical companies, which can assist with research infrastructure and research skills.

The time frame for these benefits ranges from short term (undertaking worthwhile research, securing non-financial benefits), to very long term (benefitting economically from new compounds that are discovered). The impression gained from stakeholders is that the collection and research into Sri Lanka's bio diverse resources is presently undertaken to a minimal extent only. There is scope therefore for there to be more efforts applied to capitalizing on this unique resource. These greater efforts could include for example, establishing a research center focused upon:

1. Collecting and cataloguing Sri Lanka's bio diverse resources.
2. Identifying and extracting compounds from collections.
3. Collaborating with research partners and biotechnology and pharmaceutical companies to screen those compounds for bioactivity.

The present Government practice of requiring joint ownership of intellectual property arising from research undertaken upon Sri Lanka's bio diverse resources must be reconsidered, giving Sri Lankan permit holders the freedom to decide on appropriate models of ownership of the intellectual property that they create.

The joint ownership requirement is no doubt motivated by the objective to protect Sri Lanka's bio diverse resources and to accrue economic benefits from its exploitation to Sri Lanka. That is a very worthwhile objective, which should be pursued with determination. However, the means to achieve that objective, mandating joint ownership with the Government, needs to be reconsidered.

One consequence of insisting on such joint ownership with Government is to deter research collaborations. A university seeking to collaborate with an overseas collaborator will find that the collaborator may be deterred in entering into a collaboration if it cannot own the intellectual property that it creates, which is the implication of a condition in a permit that intellectual property arising from research upon bio diverse resources be jointly owned by the Sri Lankan university and Government.

Given that Sri Lanka does not presently have all the research and technical skills as well as the research equipment and infrastructure to identify and exploit its bio diverse resources, it needs to collaborate with overseas universities, research institutions, and biotechnology and pharmaceutical companies. Such collaborations are indispensable for the effective exploitation of its bio diverse resources and ultimately for building local research and development capability.

Assuming that despite these difficulties, a Sri Lankan university has successfully arrived at a research output from a bio diverse resource, the intellectual property of which it now owns jointly with the Government, a further consequence of such an arrangement is the difficulty of attracting a licensee for such a patent. Section 89 of Sri Lanka's Intellectual Property Act requires that a license be granted by all the joint owners. Effectively, no joint owner may grant a license without the consent of the other joint owners. The patent legislation of almost all countries has a similar provision, so section 89 accords with international best practice.

Potential collaborators, like overseas universities, research institutions, and biotechnology and pharmaceutical companies, which will make a significant financial and resource investment in developing a drug, over a period of at least 10, and perhaps up to 20 years, will be deterred to collaborate, if there is a joint owner such as government, which can be perceived to be risk averse, and not necessarily able make the commercial decisions that may be required.

Other international best practice measures that could be taken, as an alternative to joint ownership, include:

1. Issuing a permit to a pharmaceutical company to collect bio diverse resources on the condition that it pays a royalty to the Sri Lankan Government on drugs that are developed using bio diverse resources that are collected.
2. Issuing a permit to a university or research organization to collect bio diverse resources on the condition that it pays to the Sri Lankan Government a percentage of its income from the commercialization of intellectual property developed with the assistance of bio diverse resources that are collected.
3. Issuing a permit to a pharmaceutical company to collect bio diverse resources on the condition that it provide short term benefits to Sri Lanka such as training of researchers, and the funding of new laboratories and research equipment.

6.7 SKILLS DEVELOPMENT

6.7.1 Patent drafting

Consideration could be given to setting up a panel of scientists, who will be available to undertake patent drafting consultancy assignments. This panel would have to be trained in patent drafting skills. Once the trained panel was established, and its members were engaged to draft patent specifications, for example, by Sri Lankan legal firms that prosecuted patent applications, the panel members would accumulate drafting experience that ensured that patent claims for Sri Lankan patents were prepared with the maximum robustness that could be achieved. WIPO has conducted patent drafting workshops in Sri Lanka, one as recently as in 2013. WIPO can consider repeating those successful workshops in Sri Lanka.

6.7.2 Searching patent databases

The evidence is only anecdotal, but there is much of it. That is that many research projects undertaken in the world will only generate knowledge that unbeknown to the researchers, is already patented, or already in the public domain. The regrettable result is that much research funding is wastefully expended, only to learn that which is already known.

Sophisticated research organizations mandate that the merits of a proposed research project be assessed in the planning stage, including by reference to the existing state of knowledge in the field in which the proposed project lies. This ensures the following:

- If the knowledge already exists, it should be located, so that
    - the benefits of the proposed research can be realized immediately, without any expense, and
    - research funding and resources need not be spent on its duplication, which frees up research funding and resources for other projects.
- If the knowledge already exists, but it needs extension, customization, or application in a different environment , a more meaningful research project can be designed.
- If the knowledge does not yet exist, the proposed project can be confidently pursued.

SLINTEC reported that every proposed research project, in the planning phase, is the subject of patent searches and literature searches. In this way, SLINTEC investigates the scientific merit of the proposed project (“let’s not redo that which has already been done”) and the commercial merit of the proposed project (“let’s focus on what we can do to make an economic impact”).

Searching the academic literature is a skill that all researchers have. Searching patent databases is a skill that, for the purposes of assessing the merit of proposed research projects, researchers can acquire. Other research organizations in Sri Lanka can follow from SLINTEC’s example, by adopting a process of literature and patent searching in the project planning phase, to ensure that the most meaningful and up to date research is undertaken, without duplicating that which is already known, and minimizing wasted financial and other resources. Public sector research funding granting bodies in Sri Lanka could consider including as part of their merit assessment of competing applications for public research

funding, the applicant's analysis of the result of the applicant's literature and patent searches, including the robustness with which they have been undertaken.

Another important benefit of searching patent databases arises from the fact that patents operate territorially. That is, patents granted in one country or region are valid only in that country or region. Therefore, a patent granted in a country other than Sri Lanka, but not granted in Sri Lanka, can be validly used and exploited in Sri Lanka. That is, such use and exploitation in Sri Lanka would not be an infringement.

This presents the opportunity for Sri Lankan researchers to identify technology which can be useful to Sri Lanka's economic development that has been patented in other countries, but not in Sri Lanka. The result is:

- the ability to use and exploit that intellectual property in Sri Lanka, without fear of infringement, and without royalty or other financial obligations to the holder of patents granted in other countries and
- further research on that technology can be undertaken, to adapt it to Sri Lanka's needs and conditions, generating new or complementary intellectual property that can be useful for Sri Lanka's economic development.

Care must be taken not to use technology in these ways, where the products developed from the technology will be exported to countries where patents have been granted, since the importation of those products into those countries may be an infringing act. There is no such concern however where such products are sold in Sri Lanka, or exported to other countries where similarly no patents have been granted.

Undertaking searches in this way, in Sri Lanka, will become easier with the establishment throughout Sri Lanka of Technology and Innovation Support Centers.

6.8 PRIVATE SECTOR FUNDING

Lending from banks (or what is called debt financing) is generally not available as a source for capital in the innovation system. Banks require "bricks and mortar" security or a proven successful business with reliable revenue and cash flows to provide security. As a rule, a technology start-up company has neither "bricks and mortar" security, nor an operational business, and usually is also without revenue or cash flows. Possible private sector funding to support the innovation system therefore tends to rely on equity capital from venture capitalists or angel investors.

As we have seen in section 3.5 there is one venture capital firm and one angel investor network in Sri Lanka. Steps may be taken to strengthen these pioneering efforts as well as to encourage others to participate in providing risk capital for science and technology entrepreneurial opportunities. In India, for example, all income realized by a venture capital fund from its investments is tax exempt.[65] This explains the explosion in India of the number of venture capital funds operating, understood to be over 300, including many United States venture capital funds with affiliated Indian offices. Other measures to encourage venture capital funds include:

- concessional rates of taxation, and
- setting funds up with government assistance.

Diverse policies have been introduced in other countries to encourage private investment in, and entrepreneurship by the formation of technology based start-up companies.

- In Malaysia, companies that undertake contract research and development services are eligible for pioneer status, which enables them to enjoy tax exemption on their income from providing those contract research and development services for a period of 5 years. Also in Malaysia, commercialization income received from commercializing the results of research enjoys a 50% tax exemption for a period of 5 years.
- In France, those who license out technology benefit from a reduced company income tax rate of 15% on the income, including royalties and other license payments they receive under their license agreements. They still pay the usual company tax rate of 33.33% on other income. This applies to licenses granted not just to French licensees, but also to licensees in other countries. It therefore strongly fosters international technology transfer.
- The United Kingdom in April 2013 commenced the phasing in of a lower corporate tax rate for income derived from the commercialization of patents. Profits earned from the commercialization of patents will attract a reduced corporate tax rate, lowering it from 24%, progressively over 4 years, until it reaches 10% in April 2017. The usual tax rate will continue to apply to a company's other income

[65] Section 10 (23FB) Income Tax Act 1961 (India)

CHAPTER 7 – RECOMMENDATIONS

1. Policy and legal framework and their implementation
    a. Innovation is a cross cutting issue and, as such, different ministries, agencies and departments may have responsibilities that would contribute to the overall national goal of strengthening the national innovation system. However, there needs to be a single entity, whether that would be a ministry, agency or a department that would be given the responsibility to manage, coordinate and ensure the proper functioning of the national innovation system on the basis of a time bound, adequately funded, implementation plan. Such an entity would actively engage with all stakeholders; whether government, research or industry so as to ensure coordination, reduce overlap and minimize waste towards a single national objective of ensuring a functioning national innovation system.[66]
    b. Study the appropriateness and relevance, in close consultation with WIPO (and UPOV where relevant), of measures for dealing with the compulsory disclosure of the country of origin of a genetic resource when it is the subject of patent claims, laws dealing with the protection of plant breeders rights, a utility model system and accession to the to the Madrid Protocol

2. Improving research capability
    a. For science and technology to make a contribution to Sri Lanka's economic development, the level of research and development undertaken in Sri Lanka will need to increase substantially. It is therefore recommended that Sri Lanka formulate and implement a plan to progressively invest more public sector monies in research, so that over a period of 5 years it is increased from its current level of 0.16% of GDP to 1% of GDP, with the aim of progressively increasing it beyond that.
    b. Review the structure of employment of academics in higher education so as to allow greater opportunities for research and that such research be more demand driven and applied while maintaining a balance with curiosity driven and fundamental research.
    c. Adopt policies to improve job opportunities for researchers in Sri Lanka which include increasing research funding, increasing investment in laboratories and research equipment as well as exploring mechanisms to attract Sri Lankan scientists working abroad to return to Sri Lanka, even for short durations.
    d. Review policies dealing with all aspects of procurement, and administrative procedures, so far as they affect research organizations, to ensure that they operate more efficiently, and assist rather than impede research and commercialization objectives
    e. Allocate research resources (such as funding) so as to achieve a desirable balance between research that has short, medium and long term prospects of contributing to Sri Lanka's economic improvement.
    f. Maintain a register of Sri Lankan researchers in other countries, which could be used to explore opportunities for international research collaborations

[66] It is recognized that perhaps COSTI has been established to do just that. This recommendation therefore strengthens and supports that effort.

between Sri Lankan researchers and their countrymen at overseas research institutions. Such a register would also have the benefit of identifying Sri Lankan experts and their expertise located in different parts of the world that could be drawn on for specific needs in Sri Lanka.

g. Consider adopting a two stream funding approach to research funding, with one stream exclusively applied to basic or fundamental research, and the other stream exclusively to applied or industrially relevant research.

3. Management of research output
    a. All Ministries and government departments and agencies in Sri Lanka apply a consistent policy that ownership of intellectual property arising from research that they fund, vest in the university or institution which generated that intellectual property, that is the grant recipient.
    b. That the National Science Foundation be urged not to depart from international best practice, and continue to vest ownership of intellectual property arising from research that it funds, in the university or institution which generated that intellectual property.
    c. Prepare guidelines on the advantages and disadvantages of particular commercialization pathways (utilization, licensing, and assignment) for the assistance of research organizations.
    d. Take steps to establish in larger universities and research organizations technology management offices (TMOs) and a single TMO to serve the collective needs of smaller universities and research organizations. The Government should provide financial support to establish these TMOs and explore the prospect of internships for TMO staff at overseas TMOs.
    e. Review the Ministry of Finance's policies relating to university funding so that they do not operate to impede the formation by universities of technology start-up companies.
    f. Universities and research organizations be given a generous period, such as one year, to put in place an Intellectual Property Policy, and that after that time, they be ineligible to apply for research grants from government or government agencies, if such a policy has not been put in place.
    g. Amend the Universities Act 1978 to specifically refer to research and commercialization being part of the mission of universities.
    h. Prepare a model Intellectual Property Policy and model policy infrastructure of processes and standard operating procedures to be adopted, or adapted by Sri Lankan universities and research organizations as they see fit.
    i. That the model Intellectual Property policy include provision for incentives to be provided to inventors, in the form of sharing a percentage of commercialization revenues received by the university or research organization.

4. Patent database search
    a. Research organizations adopt a process of literature and patent searching in the project planning phase, relying if possible on the Technology and Innovation Support Centers, to ensure that the most meaningful and up to date research is undertaken, without duplicating that which is already known, and minimizing wasted financial and other resources.
    b. The public sector research funding granting bodies in Sri Lanka consider including as part of their merit assessment of competing applications for public research funding, the applicant's analysis of literature and patent searches, including the robustness with which they have been undertaken.
    c. Encourage the identification of technology patented in other countries, but not in Sri Lanka, which can be adapted to meet the needs and conditions in Sri Lanka.

5. Building linkages between research and industry
    a. Undertake a study to map the research capabilities of research organizations, the research needs of industry, and match the capability with the need, and facilitate the introduction of individuals from both research organizations and industry, to explore how they can assist each other.
    b. Introduce an innovation voucher system to assist in building links between industry and universities and research organizations.
    c. Provide incentives such as was done in India to help foster a venture capital industry.
    d. Establish amongst the new research funding programs, a program of funding where the criteria for funding would include a percentage (such as 50%) of the proposed research being funded by the Government, and the remaining 50% being funded by an industry partner.
    e. Apply all of the levies raised in particular industries exclusively to funding research in that industry, in the research institute set up for that purpose.

6. Skills development
    a. Provide greater resources to schools for laboratories and science teaching staff.
    b. Put greater emphasis on the teaching of science in schools
    c. Establish a panel of patent drafters in Sri Lanka who would be trained in patent drafting skills, and available thereafter to undertake patent drafting consultancy assignments.
    d. Provide broad IP management knowledge and skills to SME intermediaries

7. Bio-diversity
    a. Undertake an assessment of the feasibility of establishing a research center that is focused upon collecting and cataloguing Sri Lanka's bio diverse resources, identifying and extracting compounds from collections, and collaborating with research partners to screen compounds and discover new drugs.

b. Reconsider the present Government practice of requiring joint ownership of intellectual property arising from research undertaken upon Sri Lanka's bio diverse resources, and allow Sri Lankan permit holders to decide on appropriate models of ownership of the intellectual property that they create. Explore other more commonly encountered mechanisms to secure benefit sharing to Sri Lanka and formulate a new policy for benefit sharing, based on international best practice

8. Balance the areas of science to be supported by research funding and the extent of research funding in assessing competing calls for research support.

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ANNEX 1 - LIST OF INTERVIEWEES (STAKEHOLDERS)

1. Blue Ocean Ventures (PVT) LTD, Mr. Prajeeth Balasubramaniam, Managing Director
2. Coconut Research Institute, Dr. Ananda Tennakoon, Head, Soils and Plant Nutrition Division
3. Coordinating Secretariat for Science, Technology and Innovation, The Hon. Minister Professor Tissa Witharana, Senior Minister, Scientific Affairs, Dr Geetha Abeysinghe, Director, IT, Prof Ajith P. de Alwis, Project Director, Prof Sirimali Fernando, Chief Executive Officer, Dr M. T.Kumudini Gunasekare, Project Scientist
4. Dilmah, Ms Jayanga Wegodapola, Head of Legal, MJF Holdings Ltd
5. Industrial Technology Institute, Dr Radhika Samarasekara, Additional Director (R&D)
6. Institute of Fundamental Studies, Professor S.A. Kulasooriya (visting professor), Professor Lakshman Dissanayake (research professor)
7. Institute of Policy Studies of Sri Lanka, Mr Anushka Wijesinha, Research Economist
8. Institution of Engineers, Sri Lanka, Eng. Jayavilal Meegoda, Vice President 2013/14
9. John Keells Group, Dr Muditha Senarath-Yapa, Head of Research and Vice President
10. Kapruka, Dulith Herath, CEO
11. Lankan Angel Network, Mr Eric Wikramanayake, Chairman
12. Microimage (pvt) Ltd, Mr Harsha Purasinghe, Chief Executive Officer
13. Ministry of Agriculture, Mr T.M.K.P.K. Hemaratna, Monitoring Officer
14. Ministry of Education, Mr K.M.D.S.D. Karunaratne, Deputy Director Statistics, Department of Census and Statistics
15. Ministry of Higher Education, Dr. Sunil Jayantha Nawaratne, Secretary, G.M.R.D Aponsu, Director Planning
16. Ministry of Industry and Commerce, Mr. Anura Siriwardena, Secretary, Mrs. Sheitha Senarathna, Additional Secretary (Commerce), Asitha K Seneviratne, Additional Secretary (Policy Development)
17. Ministry of Technology and Research, Patali Champika Ranawa, Minister, Dhara Wijayatilake, Secretary, Wasantha Perera, Additional Secretary (Technology & Research Development), Madhawa Waidyaratna (Technology Transfer).
18. National Enterprise Development Authority, Lakshman Thrimawithana, Assistant Director (Policy)
19. National Engineering Research and Development Centre of Sri Lanka, Eng. D. D. Ananda Namal, Director General
20. National Science Foundation, Dr Thamara Dias, Head, Technology Division, Mr. D. N. Wickramarachchi, Scientific Officer and Mr. J.G. Shantha Siri, Scientific Officer, Dr. P.R.M.P. Dilrukshi, Acting Head, The Science and Technology Policy Research Division

21. National Science and Technology Commission, Professor Dhammika Tantrigoda, Chairman
22. Rubber Research Institute, Mrs. Dilhara Edirisinghe, Acting Head, Rubber Technology and Development Department
23. Sri Lanka Chamber of Commerce, K.A.V. Oshadi Kodisinghe, Manager Legal
24. Sri Lanka Inventors Commission, Deepal Sooriyaarachchi, Commissioner
25. Sri Lankan Institute of Nanotechnology, Harin De Silva Wijeyeratne, Chief Executive Officer, Professor Veranja Karunaratne, Science Team Leader, Professor Nalin De Silva, Science Team Leader Shehan de Silva, Manager Strategic Planning/Senior Scientist,
26. Tea Research Institute of Sri Lanka, M.A. Wijeratne, Senior Research Officer and Officer in Charge
27. University of Colombo, Dr. Kumara Hirimburegama, Vice Chancellor, Professor Dilip De Silva, Senior Professor, Department of Chemistry, Professor Thusitha Abeytunga, Professor, Department of Chemistry, Dr. Shiroma Handunnetti, Senior Lecturer in Immunology, Institute of Biochemistry, Molecular Biology and Biotechnology, Dr. Rasika Dayarathna, Department of Communication and Media Technologies
28. University of Moratuwa, Professor Ananda Jayawardane, Vice Chancellor, Samanmalee Harischandra, Attorney at Law
29. University of Peradeniya, Professor M.A.K. Lakshman Dissanayake, Manjula Sandirigama (patent attorney)
30. University Grants Commission, University Grants Commission, Professor Ranjith Senaratne, Vice Chairman and Senior Professor Crop Science, University of Ruhuna
31. Zone24X7, Dr. Sankalpa Gamwarige, General Manager/VP Engineering, Ushan Karunathilaka, Senior Architect, Complex and Smart Systems

ANNEX 2 - WIPO MISSION TO SRI LANKA

- Mrs. Tamara Nanayakkara, Head, Innovation Policy Section, Innovation Division
- Mr. Philip Mendes, Principal, Opteon, Australia

Mr Nalinda Thusitha from the Sri Lankan intellectual Property Office, and Dr Kumudini Gunasekare from the Coordinating Secretariat for Science Technology and Innovation (COSTI) accompanied the WIPO mission and participated in the interviews.