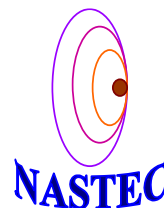# SCIENCE AND TECHNOLOGY
STATUS REPORT OF SRI LANKA - 2019

NASTEC

National Science and Technology Commission
Ministry of Education

SCIENCE AND TECHNOLOGY STATUS REPORT OF SRI LANKA - 2019

(Prepared based on the data collected from 42 Public Sector S&T Institutions)

National Science and Technology Commission

(Ministry of Education)

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THE MESSAGE FROM THE MINISTER OF EDUCATION

The Science and Technology (S&T) Status Report of Sri Lanka is a document prepared by the National Science and Technology Commission (NASTEC) as per the S&T Development Act No. 11 of 1994. Accordingly, compiling such a report by reviewing the S&T activities in the country in the preceding year and submitting it to the government annually is one of the national tasks of the Commission. This report evaluates the status of the inputs for national research and development (R & D) activities against their outputs while benchmarking with global indices. It would enable the local system to track the stocks based on the global policy commitments annually, such as the Sustainable Development Goals, and cope with climate change.

Based on the information gathered for 2019, NASTEC has proposed a set of policy recommendations to improve the performance of the S&T sector in Sri Lanka within the scope of the above.

I thank NASTEC for their hard work towards successfully completing this national task by collecting data from relevant stakeholders and institutions and proposing timely and beneficial recommendations. I also take this opportunity to thank the chairpersons and CEOs of the S&T institutions who provided information to make this endeavour a success.

Dr. Susil Premajayantha
Hon. Minister of Education
Leader of House, Sri Lanka Parliament

01 September 2023

FOREWORD

The National Science and Technology Commission (NASTEC), established by the Science and Technology Development Act No. 11 of 1994, functions under the purview of the Ministry of Education. One of the mandatory functions of the Commission is to compile and submit a report annually to the government, reviewing the science and technology (S&T) activities of the country in the preceding year. In order to examine the S&T activities that occurred in the year 2019, a survey was undertaken to gather relevant data from the public sector S&T institutes. This report was prepared based on the data gathered from 42 public sector S&T institutions that responded to the survey. The report reflects the performance of those public sector institutions under the sub-categories of (i) effectiveness of public spending on S&T, (ii) use of S&T developments, (iii) services provided by national S&T institutions, and (iv) development of human resources. The data gathered through this survey will be a good knowledge source that will collectively determine the current S&T capacity of those institutions. It will also assist in identifying gaps in the respective sectors. The recommendations proposed in this report can be used to improve relevant institutes by implementing appropriate interventions, including policies, R&D interventions, capacity development, etc.

This report is regarded as an innovative document that offers an additional perspective on the scientific environment at public sector S&T organizations. We are confident that the analysis of this report will promote the information production necessary for the public sector S&T institutions' decision-making while contributing to providing relevant directions for enhancing performance.

I would like to take this opportunity to express my gratitude to the Chairmen, Directors, and CEOs of the public S&T institutions who provided the necessary data and information in order to complete this report and to congratulate the NASTEC staff for their dedication to producing the S&T status report for the year 2019.

Prof. Veranja Karunaratne

Chairman

NASTEC

08 August 2023

PREFACE

The National Science and Technology Commission (NASTEC), by its mandate under Science and Technology Development Act No. 11 of 1994, is the apex policy-formulating and advisory body on science and technology (S&T) matters to the Government of Sri Lanka. Accordingly, as one of the mandated activities, NASTEC has to review the S&T activities in Sri Lanka in the preceding year on the effectiveness of measures for the development of human resources, the performance of science and technology institutions, the effectiveness of public spending on S&T, and the use of them by the public sector and private sector undertakings to report to the government[1].Within this context, the NASTEC was able to gather the information of 42 public-sector S&T institutions out of 65 through a survey for the year 2019.

The information was collected across five broad areas from them: i) Human resources; ii) Physical resources; iii) Research inputs; iv) Research outputs; and v) Institute services and data were analyzed to determine the institutes' national contribution to the sector. The inferential findings of the report are useful in identifying appropriate activities that could be implemented to improve the performance of the sector.

We are grateful to the chairpersons, heads of the institutions that participated in the survey by providing their institutional data, and liaison officers appointed by the institutions for their extended support in the entire process, which allowed NASTEC to compile this report successfully. We also appreciate the valuable advice and direction provided by the Commission-appointed subcommittee, the Acting Director, and the NASTEC team who got involved in preparing this publication.

Seyed Shahmy
Senior Scientist

08 August 2023

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[1] Science And Technology Development Act (No. 11 of 1994);
http://www.commonlii.org/lk/legis/num_act/satda11o1994368/s5.html

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ACRONYMS

ACCIMT – Arthur C Clarke Institute of Modern Technology

ACR- Annual Project Completion Rate

APC-Article Processing Charges

BIMSTEC – Bay of Bengal multi-sectorial technical cooperation

BMARI – Bandaranayake Memorial Ayurvedic Research Institute

CEA – Central Environmental Authority

CBSL-Central Bank of Sri Lanka

DOM – Department of Meteorology

EAD – Department of Export Agriculture

EOLSS – Encyclopedia of Life support Systems

FD – Forest Department

FMRC – Farm Mechanization Research Centre

FORD – Fields of Research and Development

FRDI – Fruit Research Development Institute

FUR – Fund Utilization Rate

GDP – Gross Domestic Product

GERD – Gross Domestic Expenditure on R&D

GJRTI – Gem and Jewelry Research and Training Institute

GoSL- Government of Sri Lanka

GSMB – Geological Survey and Mines Bureau

HARTI – Hector Kobbekaduwa Agrarian Research and Training Institute

HORDI – Horticultural Crop Research and Development Institute

HRD – Human Resource Development

HRST – Human Resources in Science & Technology

ICT – Information Communication Technology

IP-Intellectual Property

IPHT – Institute of Post-Harvest Technology

IPR – Intellectual Property Rights

ISCED – International Standard Classification of Education

IT – Information Technology

ITI – Industrial Technology Institute

LKR – Sri Lankan Rupees

MRI – Medical Research Institute

NASTEC – National Science and Technology Commission

NBRO – National Building Research Organization

NERDC – National Engineering Research and Development Centre

NIFS – National Institute of Fundamental Studies

NPQS – National Plant Quarantine Service

NPD- National Planning Division

NRC – National Research Council

NRDF – National Research and Development Framework

NRMC – Natural Resources Management Centre

NSF – National Science Foundation

NSTP – National Science and technology policy

OECD – Organization for Economic Co-operation and Development

PGRC – Plant Genetic Resource Centre

PPP – Public Private Partnerships

PPS – Plant Protection Service

R- Range

R&D – Research & Development

RPO – Office of the Registrar of Pesticides

RRDI – Rice Research and Development Institute

RRI – Rubber Research Institute

SAARC-South Asian Association for Region Cooperation.

S&T – Science and Technology

SCI – Science Citation Index

SCI Extended- Science Citation Extended

SCPPC – Seed Certification and Plant Protection Centre

SCS – Seed Certification Services

SDGs – Sustainable Development Goals

SLAB – Sri Lanka Accreditation Board for Conformity Assessment

SLAEB – Sri Lanka Atomic Energy Board

SLCARP – Sri Lanka Council for Agricultural Research Policy

SRI – Sugarcane Research Institute

STS- Science and Technology Services

TOT – Transfer of Technology

TTF- Technology Transfer Facilities/Office

TRI – Tea Research Institute

UIS – UNESCO Institute of Statistics

WB- World Bank

WIPO- World Intellectual Property Office

UNESCO – United Nations Educational, Scientific and Cultural Organization

UNCTAD-United National Conference of Trade and Development

VRI – Veterinary Research Institute

EXECUTIVE SUMMARY

The Science and Technology Status Report of 2019 was compiled based on data collected from 42 public sector science and technology (S&T) entities in Sri Lanka in compliance with international guidelines for reporting on S&T[2]. The report aims to provide comprehensive information on the activities in the year through a wider analysis to draw a set of conclusions and provide recommendations as per the objectives set out in the S&T Development Act No. 11 of 1994[3,4.]

The surveyed institutions employed 7813 people in total, the majority of whom (>95%) were full-time staff members. There were 1:1.2 cadre posts for scientific and non-scientific, and among the scientific cadre (n = 3565), researchers made up 41% (n = 1452), and women made up 53% (n = 769) of the researchers, exceeding the global gender equity representation average of 46% for women[5]. Nonetheless, comparatively the percentage of women in the institutions' sectoral breakdowns was lower (41%), especially in the natural sciences. On the other hand, according to the academic discipline of the researchers, there was a significant percentage of female representation (59%) in the natural sciences. In the social sciences, the tendency was reversed. It demonstrates that a researcher's affiliation with the sector of the institution is not always pertinent to their field of study, especially in the natural and social sciences.

Most of the researchers were working in institutions of agriculture and veterinary sciences', followed by engineering and technology. The average number of researchers working at an institute was 34, with a consistent pattern over the decade. Most of the researchers were in their mid-career stages, with only 14% holding a PhD. It is also revealed that most of the institutions had incomplete recruitment for the scientific cadre vacancies, with an administrative issue as a notable reason for such a delay. The employee turnover rate for researchers was 6% among the surveyed institutions, which is lower than the global average of 10.6%. However, the Human Flight and Brain Drain Index revealed that Sri Lanka had an average value of 7.10 (R: 0-10) index points for the same period, which is rather a worse scenario in the global rankings[6]. Further research shows that 50% of Sri Lankan expats had PhDs, which is quite alarming. The

[2] OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris; DOI: http://dx.doi.org/10.1787/9789264239012-en

[3] Science & Technology Development Act 1994/11: http://www.nastec.gov.lk/files/nastec_act/English_Copy.pdf

[4] Law of Sri Lankahttps://www.srilankalaw.lk/revised-statutes/volume-vii/1090-science-and-technology-development-act.html

[5] World bank Blog ; https://blogs.worldbank.org/governance/five-facts-gender-equity-public-sector

[6] https://www.theglobaleconomy.com/Sri-Lanka/human_flight_brain_drain_index/

most recent BIMSTEC statistics also show that Sri Lanka still has the region's lowest researcher-to-population ratio of 106.5 in the reporting period[7].

Only a few PhDs were among the 85 funded postgraduate degrees under foster employee development offered to scientific cadres. A total of 2409 scientific staff attended training workshops and conferences, of whom 12% attended foreign events. To ensure the optimal use of the funds allocated for such activities, a system must be put in place to evaluate their impact on the system on a long-term basis.

The institutions were equipped with 324 research laboratories, 36 workshops, 41 libraries, and 85 auditoriums. Some of which included specific facilities such as mobile labs, research incubators, pilot plants, museums, plant nurseries, and technological parks. All the institutions were provided with basic ICT facilities, including internet access. Twenty-six of them also had a dedicated database to support their R&D services.

The National S&T Policy and the National Research and Development Framework, which the cabinet approved as comprehensive policies and frameworks for the STI sector, respectively[8,9], were integrated with the majority of these institutions' R&D activities. As a result, major projects are primarily focused on the fields of agriculture, food, and nutrition because of their importance to the global goals—including the SDGs of zero hunger, industry, innovation, and infrastructure—and the Paris Accord.

The institutions received LKR 4216.72 million in total for infrastructure improvement and R&D initiatives. Their principal source of funding was the Government of Sri Lanka (GoSL). The fund utilisation rate (FUR) was 93% (range: 65% to 99%), with agricultural and veterinary sciences having the highest rate and natural sciences having the least. Sri Lanka has the lowest R&D expenditure (% of GDP) in the region at 0.13, according to the latest statistics. While most of the Nation's shows an upward trend, Sri Lanka shows a downward trend. It urges an increase in funding for R&D activities.

There were 748 research projects conducted, with 78% of them in the sectors of agriculture and veterinary sciences. The project's annual completion rate (ACR) was 21%. Fifty products,

[7] Janodia M, Narayan AI, Venkata SK and Chogtu B. Publication analysis in Bay for Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation Nations [version 1; peer review: 2 approved]. *F1000Research* 2021, 10:510
(https://doi.org/10.12688/f1000research.52286.1)
[8] National Science and Technology Policy (2008);
http://www.nastec.gov.lk/files/national_science__technology_policy_of_sri_lanka_english.pdf
[9] National Research and Development Framework (2016), http://www.nastec.gov.lk/reports/nrdf

25 processes, and 29 technologies were generated in all. A total of 1265 scholarly works, of which 50% were conference proceedings, were published in various scientific outlets. Of them, only 12% of articles were able to get published in the indexed journals. The number of publications produced per institution was 21. A system in place to recognise funding schemes, such as research excellence and financial incentives, to cover at least the journals' article processing charges (APC) is a need of the hour.

The research community was awarded 39 accolades, including 10 international honoraria. Eleven patents, including 10 international ones, were also issued. For the initial customer groups targeted for market adoption, forty items and seven processes were created. During the same time span, 54 technologies were transferred, and 36 recommendations were also adopted.

Strategies such as tracking employee turnovers, improving financial incentives, establishing postgraduate fellowships, fostering mentorship programmes, and promoting international collaborative R & D activities may attract highly skilled researchers to remain in the system. Optimal utilisation of physical resources, induce a set of performance indicators, and streamline the procurement process, which could all play a role in enhancing the operational value chain efficiency of research projects. Linking the institutions to a common virtual platform to facilitate real-time information sharing can enrich the data-driven decision-making at the interfaces of the entire value chain process within the STI ecosystem.

Strengthening funding for R&D activities linked to national priorities is recommended. Innovation-driven academia-industry partnerships, entrepreneurship, sustainable practices, and continual monitoring and evaluation of them are all encouraged for their effective implementation at the policy level. An econometrically driven STI strategic master plan to contribute to the national economy, including addressing the gap in research commercialization, is the need of the hour. Establishing technology transfer facilities, innovation hubs, technology parks, and technology adoption programmes may all encourage this. Streamlining regulatory processes and upgrading service delivery in S&T institutions are also identified as ways to facilitate efficient and timely deliverables.

INTRODUCTION

The National Science and Technology Commission (NASTEC), established by the Science and Technology Development Act No. 11 of 1994, is the apex policy-formulating and advisory body on Science and Technology (S&T) matters for the Government of Sri Lanka. The Commission is mandated to produce an annual report to the government, assessing the country's scientific and technological status in the preceding year per the objectives outlined in Section 2 of the Act and on the effectiveness of the measures for the development of human resources, the performance of S&T institutions, the effectiveness of public spending on S&T, and the use of S&T by public and private sector undertakings[10]. In accordance with the mandate, the report aims to present the information to the stakeholders through complimentary analysis, particularly those that could be implicated at the policy level.

A national research and innovation system is made up of a set of institutions in a country, such as government institutions, public sector research organisations, universities, knowledge-based services, innovating firms, and so on, that are involved in activities to produce scientific knowledge, contribute to higher education, participate in industrial innovation, produce scientific expertise, and contribute to the strategic objectives of the country[11]. Reviewing the S&T status of a country from time to time is a very important exercise that enables a country to drive S&T to harvest the desired output for socio-economic development[12]. Hence, S&T institution efficiency has a substantial impact on the national research and innovation ecosystems, which contribute to the performance of the national economy[13].

There were two attributes considered by NASTEC while compiling the information in this report. The first, on the activities of major S&T institutions in Sri Lanka, was gathered through a questionnaire-based survey, and the rest, on related information, was gathered from the annual publications of leading global and local learned societies and bodies, such as the World

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[10] Science And Technology Development Act (No. 11 of 1994);
http://www.commonlii.org/lk/legis/num_act/satda11o1994368/s5.html
[11] National Innovation system, OECD; https://www.oecd.org/science/inno/2101733.pdf
[12] Mormina, M. Science, Technology and Innovation as Social Goods for Development: Rethinking Research Capacity Building from Sen's Capabilities Approach. SciEng Ethics 25, 671–692 (2019). https://doi.org/10.1007/s11948-018-0037-1
[13] Institutions and Economic Performance: A Review on the Developing Countries:
https://www.sciencedirect.com/science/article/pii/S2212567116302076

Bank, UNESCO, the World Intellectual Property Office (WIPO), the University Grant Commission (UGC), and the Central Bank of Sri Lanka (CBSL).

The following methodology was adapted during the data collection: 65 public-sector S&T institutes were sent a pre-structured questionnaire via email and mail. The questionnaire requested information on physical and human resources, research planning, inputs and outputs, and services offered by the institutes in the year 2019. A four-month deadline for submission was provided. The data linked to each institution was gathered by a respective liaison officer, and duly, 42 institutions responded with a complete data set.

For the analysis, the institutions were categorised into 5 groups based on the OECD guidelines in Fields of Research and Development (FORD)[14]: Natural Sciences (i), Engineering and Technology (ii), Medical and Health Sciences (iii), Agricultural and Veterinary Sciences (iv), and Social Sciences (v) - Annexure 1. Accordingly, the sectorial representation of the number of institutions surveyed is given in Table 1.

The output of data analytics was presented under six major sections in the report: human resources, physical resources, research planning, research funding, research outputs, and institutional services. Each section begins with a detailed description with a series of descriptive visualisations, followed by a number of inferential statistics, including trend analysis over a certain period. The run charts were extrapolated by calculating the average figure distributed per institute since the number of institutes included in the survey for a certain period varied. Some of the results of the survey cannot be authenticated with neither global nor regional indices of the reporting period because only a few sets of such statistics were available when the report was written. However, the report corroborates these limited claims wherever applicable. At the end of the report, the recommendations and conclusions derived from the work are summarized.

The work has certain limitations, such as the standing of private-sector institutions, and the information from the higher education sector in the country is not included. Similarly, the purpose of the work is to nationally assess the status of S&T (as mandated); only a subset of 42 institutes' data was included in the data analytics. Thus, generalising the findings of this report at the national level might be inappropriate. However, the institutions that were surveyed

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[14] UNESCO Fields of Research and Development (FORD); http://uis.unesco.org/en/glossary-term/fields-research-and-development-ford

under the work are major sectoral players in the national S&T ecosystem. Hence, the report could play a substantial role at the policy level in informed decision-making.

Table 1: Sector-wise distributions of S&T Institutes

Sector	Number of Institutes	Percentage %
Agricultural & Veterinary Sciences	19	45%
Engineering & Technology	7	17%
Medical & Health Sciences	2	5%
Natural Sciences	9	21%
Social Sciences	5	12%
Total Institutes	**42**	

From the 42 S&T institutes surveyed, the highest number of institutions were in the sector of agricultural and veterinary sciences (n = 19). A list of institutions belonging to each sector is given in Table 2.

Table 2: Sector-wise categorization of public sector S&T Institutions in Sri Lanka

Natural Sciences	Engineering & Technology	Medical & Health Sciences	Agricultural & Veterinary Sciences	Social Sciences
Central Environmental Authority (CEA)	Arthur C. Clarke Institute for Modern Technologies (ACCIMT)	Bandaranaike Memorial Ayurvedic Research Institute (BMARI)	Coconut Research Institute (CRI)	National Research Council (NRC)
Department of Measurement Units, Standards & Services (DMUSS)	Centre for Defence Research and Development (CDRD)	Medical Research Institute (MRI)	Department of Export Agriculture (DEA)	National Science Foundation (NSF)
Department of Meteorology (DOM)	Farm Mechanization Research Centre (FMRC)		Field Crops Research & Development Institute (FCRDI)	Sri Lanka Accreditation Board for Conformity Assessment (SLAB)
Department of National Botanic Gardens (DNBG)	Industrial Technology Institute (ITI)		Forest Department (FD)	Sri Lanka Inventors Commission (SLIC)
Disaster Management Centre (DMC)	National Building Research Organization (NBRO)		Fruit Research and Development Institute (FRDI)	Sri Lanka Standards Institute (SLSI)
Gem &Jewellery Research and Training Institute (GJRTI)	National Engineering Research & Development Centre (NERDC)		Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI)	
National Institute of Fundamental studies (NIFS)	Sri Lanka Institute of Nanotechnology (SLINTEC)		Department of Irrigation (DI)	

Natural Resources Management Centre (NRMC)			National Aquatic Resources Research & Development Agency (NARA)	
Sri Lanka Atomic Energy Board (SLAEB)			National Institute of Postharvest Management (NIPM)	
			Palmyra Research Institute (PRI)	
			Plant Genetic Resource Centre (PGRC)	
			Plant Protection Service (PPS)	
			Registrar of Pesticide Office (RPO)	
			Rice Research & Development Institute (RRDI)	
			Rubber Research Institute (RRI)	
			Seed Certification Services (SCS)	
			Sugarcane Research Institute (SRI)	
			Tea Research Institute (TRI)	
			Veterinary Research Institute (VRI)	

Statutory Functions of the Institutes:

An enactment or statutory instrument grants an institution its statutory functions[15]. Accordingly, the six categories of functions performed by the institutions surveyed are as follows:

1.   R & D (Research and Development)

2.   Research funding

3.   S&T Services

4.   S&T Policy Development

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[15] Law insider – Statutory functions; https://www.lawinsider.com/dictionary/statutory-functions

5.   Technology Transfer

6.   Science popularization

Table 3 lists the number of institutions according to the type of statutory functions, and Figure 1 illustrates the distribution of S&T institutions performing statutory duties by sector. Observe that certain institutions carry out multiple statutory functions.

Table 3: Major Statutory Functions conducted by S & T institutions

Statutory Function	Number of Institutions	%
R&D	35	83%
Research funding	5	12%
S&T Services	31	74%
Innovation	17	40%
S&T Policy formulation	9	21%
Technology Transfer	30	71%
Science popularization	19	45%
Training of Personal	26	62%
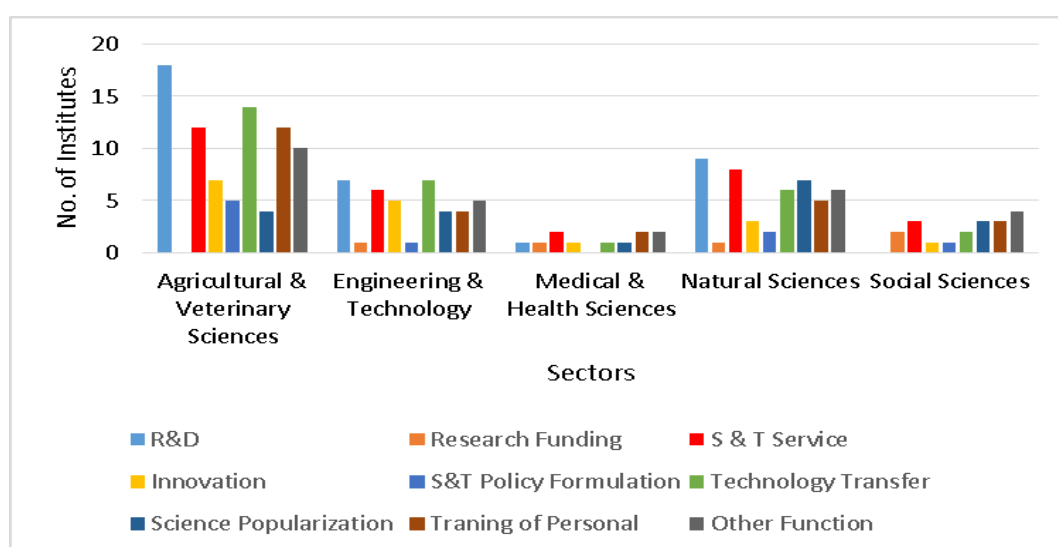
Figure 1: Sector-wise distribution of S&T institutions carrying out statutory functions

Research and experimental development (R&D) comprises creative and systematic work undertaken to increase the stock of knowledge—including knowledge of humankind, culture,

and society—and to devise new applications of available knowledge. R&D constitutes the first stage of the development of a potential new service or production process. Eighty-three percent of institutions surveyed mandated R&D as one of the main statutory functions[16].

Any funding for scientific research across the fields of science and technology, including the social sciences, is often referred to as "research funding"[17]. Accordingly, five institutions from the survey are mandated to fund the research, namely the NRC, NSF, CDRD, DMC, and MRI.

S&T services (STS) are defined in this survey as analytical testing, quality assurance, laboratory accreditation, instrument calibration, staff training, and any other specialist S&T-related services offered by the institution. Duly, 31 (74%) of the 42 institutes assessed offer at least one of these services.

The policy-making institutions are responsible for recognizing and establishing strategies to cope with STI advancements in an era of rapid technological change[18,19]. . There were 21% of institutions in the survey engaged with such policy formulation activities, either as primary or secondary statutory responsibilities.

Technology transfer (TT) refers to the process of conveying results stemming from scientific and technological research to the marketplace and a wider society, along with associated skills and procedures, and is, as such, an intrinsic part of the technological innovation process[20]. Within the survey, thirty (71%) institutes participated in technology transfer.

Science popularisation implies bringing science to the general public, disseminating scientific knowledge, and fostering a scientific way of thinking among people. This implies public understanding of science and public communication of research projects. In the survey, 19 (45%) institutions were involved in science popularisation activities.

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[16] Implementing the OECD Frascati Manual: Proposed reference items for business R&D survey (2022) :https://www.oecd-ilibrary.org/docserver/d686818d-en.pdf?expires=1695375454&id=id&accname=guest&checksum=FC8D75107E0988C011DCA4509A80B731

[17] Wikipedia
[18] THE IMPACT OF RAPID TECHNOLOGICAL CHANGE ON SUSTAINABLE DEVELOPMENT (2019); UNCTAD; https://unctad.org/system/files/official-document/dtlstict2019d10_en.pdf
[19] A FRAMEWORK for Science, Technology and Innovation Policy Reviews(2019); UNCTAD; https://unctad.org/system/files/official-document/dtlstict2019d4_en.pdf
[20] Knowledge for policy, European Commission; https://knowledge4policy.ec.europa.eu/technology-transfer/what-technology-transfer_en

1. HUMAN RESOURCES

Human resources (HR) are considered an important type of resource for attaining the economic development of a country. The efficient utilization of HR depends on the government's substantial investment in its development[21].

The Human Resources in Science and Technology (HRST) are individuals who have completed tertiary education in an S & T field and/or those who are not formally qualified in this manner but work in an S & T occupation where such qualifications are required[22]. Worldwide, Countries are migrating toward knowledge-based economies, and there is a growing demand for HRST. Knowledge-driven nations must generate a critical mass of well-trained professionals while linking with tertiary education per international standard categorization of tertiary education (ISCED), in harmony with the sectors classified in OECD, 1995.

The report categorizes the entire staff of the S & T institutions into two, namely, scientific and non-scientific. The first consists of researchers, research support/technical staff, and librarians/information officers, and the latter consists of accounting, administrative, and other staff (Definitions – table 1.1). The researchers' fields of study, the highest level of education, age and gender compositions, staff turnover, training, and the given incentives are extensively analyzed in the section HR.

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[21] The Effect of Human Resource Development on Organizational productivity: (2013)
http://dx.doi.org/10.6007/IJARBSS/v3-i10/295
[22] Guidelines for collecting and Reporting data on Research and Experimental Development (OECD 2015) ;
https://read.oecd-ilibrary.org/science-and-technology/frascati-manual-2015_9789264239012-en#page1

1.1.Definition of Staff Category

Defined terms:

Scientific staff: Includes only research staff, research support staff, and librarians & information officers.

Research staff: Professionals who possess relevant qualifications and who are responsible for the conception or creation of new knowledge, products, processes, methods, and systems, and the management of the project concerned.

Research support staff: Employees with an appropriate technical qualification or diploma who support the functioning of S&T activities in the institution, but are not involved with the planning and implementation of such activities.

E.g.: computer unit, workshop, maintenance, etc.

Librarians: Considered as informative scientists who belong to the scientific staff.

Administrative staff: All individuals who work in the institution's administration and are not directly involved in any scientific or research-related activity.

Accounting staff: All individuals employed in the institution's finance and accounting functions who are not directly involved in any science or research-related activity.

Supporting staff, non-research: secretarial, skilled/unskilled craftsmen, gardeners, animal housekeepers, etc. directly associated with or providing services to the researcher.

In 2019, a total number of 7813 employees were working in the institutes surveyed, with 7712 (98.7%) being permanent, while 101 (1.3%) were on a contract basis.

The lowest number of employees reported as 16 and 17 respectively, working for PPS and PRI, while the highest number of employees reported as 826 who have attached to Department of National Botanical Gardens. Of the total, scientific staff accounted for 45.6%, n=3565. Figure 1.1 depicts the distribution of scientific and non-scientific personnel par sector.
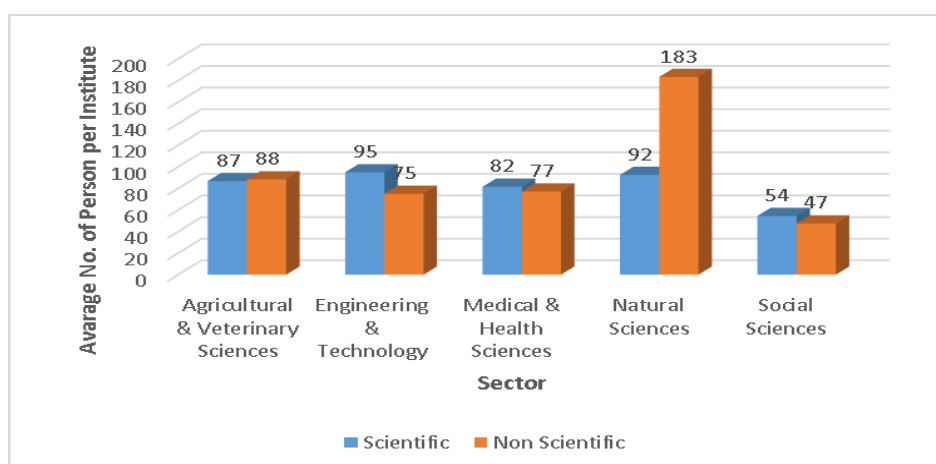
Figure 1.1: Sectorial breakdown of scientific and non-scientific staff

(***Note:** The number of staff is given within the bar.)*

Figure 1.1 gives the distribution of staff employed in each sector for scientific versus non-scientific categories. Non-scientific staff outnumbered scientific staff in the sectors of natural sciences, agriculture, and veterinary sciences, while others reported the opposite. Because of the nature of the work carried out in the sectors, the representation of the ratio may be within the perceived range. However, they were unable to be authenticated since no such global benchmarking statistics were available during the reporting period when this report was written.

Table 4: Staff Strength – Distribution of staff employed in S&T institutions

Sector	Scientific staff			Accounting Staff		Administrative Staff		Other staff	Total
	Research Staff	Research Support Staff	Librarian / Information Officers	Accountants	Acc. Support Staff	Executives	Executive. Support Staff		
Agricultural & Veterinary Sciences	500	1093	25	16	123	68	655	816	**3296**
Engineering & Technology	406	253	7	16	39	58	140	277	**1196**
Medical & Health Sciences	90	89	1	1	8	3	17	125	**334**
Natural Sciences	262	559	8	16	75	21	374	1163	**2478**
Social Sciences	194	68	10	8	38	11	154	26	**509**
Subtotal	**1452**	**2062**	**51**	**57**	**283**	**161**	**1340**	**2407**	**7813**
Total	**3565**			**340**		**1501**			

Figure 1.2 shows the distribution of the number of researchers in the institutions. The lowest number of researchers were working in the PPS (n = 3), and the highest number was 155 attached to NBRO.
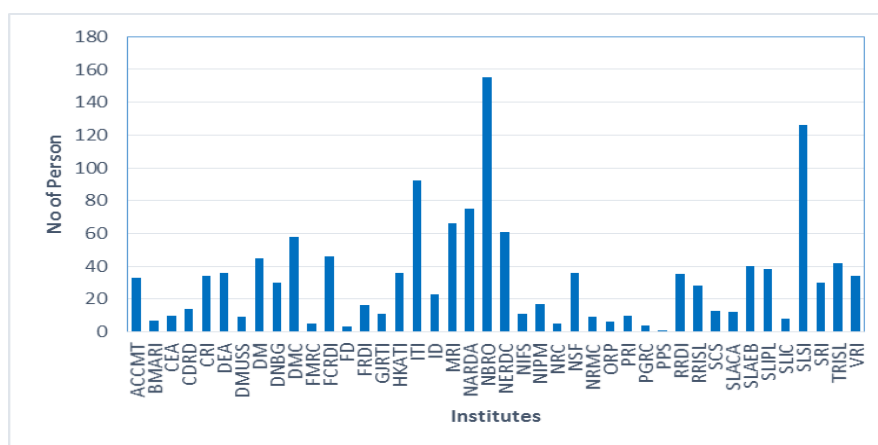
Figure 1.2: The distribution of research personnel among S&T institutions

The average number of researchers working per institute was 34, and 12 out of 42 S&T institutions (28%) have researchers less than 11. Figure 1.3 depicts the spectrum of research staff attached to the institutes. There were seven institutes (16%) that employed more than 51 researchers. Table 4 provides a list of the institutions according to the number of researchers present.
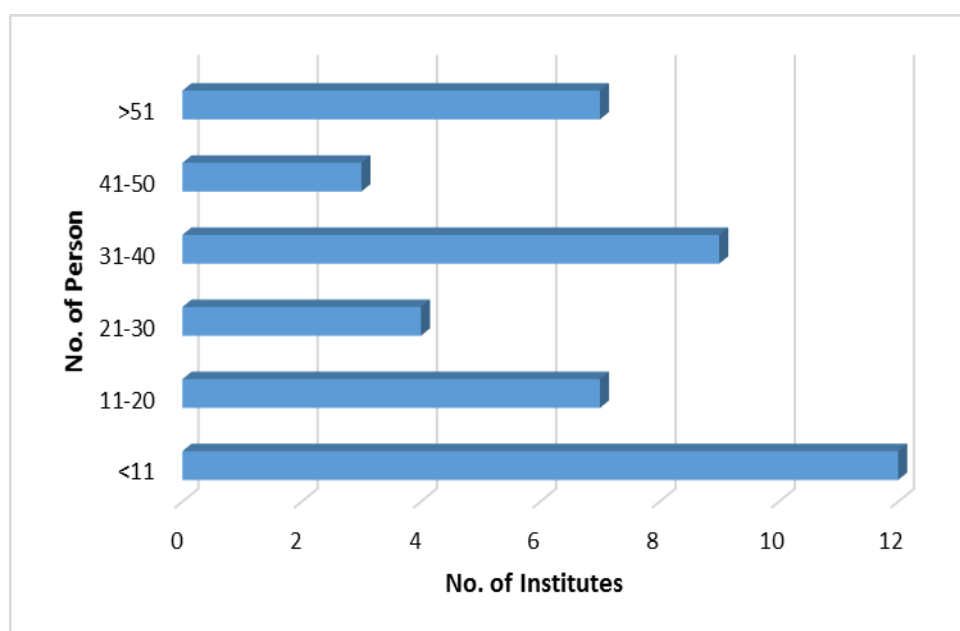
Figure 1.3: The number of researchers employed by each institute

When examining national-level norms via UNESCO statistics by applying a different matrix, such as researchers in R&D per million population, the situation is the opposite. As figure 1.4 indicates, the upward trend over the period 2008–2012 has sharply declined in 2014 and risen in 2015, even if it hasn't reached the level of 2013. Following that, there had been fluctuations in each subsequent year. However, as the graph demonstrates, the forecasted value for 2019 indicated the approximate number of researchers in Sri Lanka (per million people) as 106.57, depicting a slight inclination from the value in 2018. The upper and lower confidence bounds were indicated as 114.18 and 98.8, respectively.
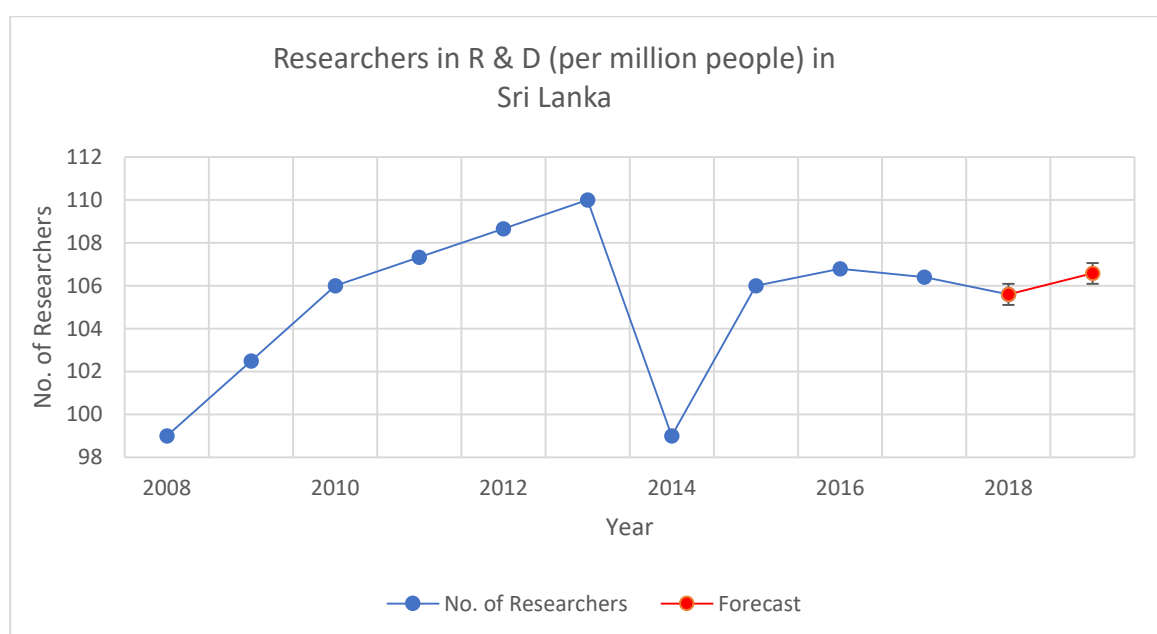
Figure 1. 3: Researchers per million Population
Source: UNESCO Institute for Statistics - 2008-2017[23] ; 2018[24]

1.2. Gender parity in Research staff (Researchers)

Figure 1.5 illustrates that 769 out of the 1452 researchers in the institutes surveyed were women, making up about 53% of the total. It shows that, however somewhat in favour of women, gender parity for researchers has been attained throughout the institutions. Nonetheless, a global study reveals that in 2019, the proportion of female researchers worldwide was 28.8%, which is half of the survey finding of 53%[25].

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[23]UNESCO Institute for Statistics -World bank
[24] http://www.nsf.ac.lk/index.php/pdf-stprd-stat-handbook-2018
[25] https://www.unwomen.org/en/digital-library/publications/2019/09/progress-on-the-sustainable-development-goals-the-gender-snapshot-2019
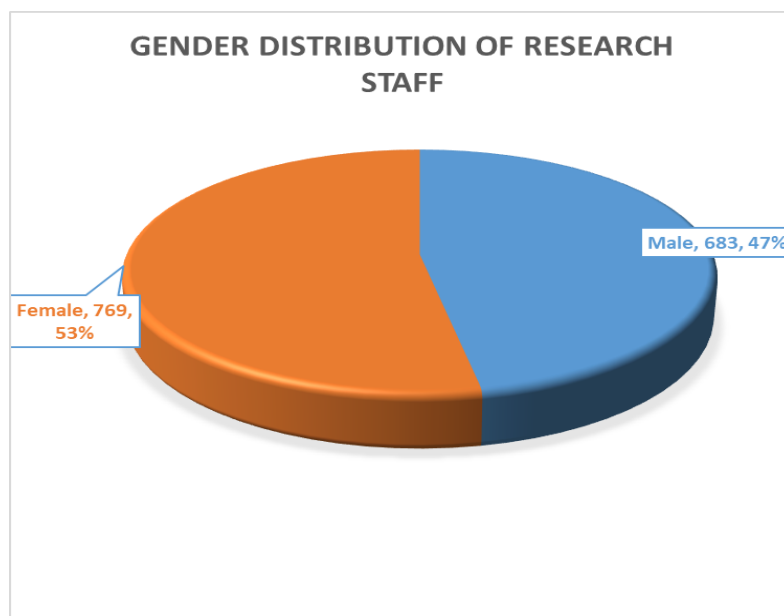
Figure 1.5: Gender distribution of research staff.

28.8%

Of the world researchers are women

In Global index it was estimated that in 2019, 28.8% of the researchers are women (UNESCO Institute of Statistics 2022(Statistical data:2019)[26]
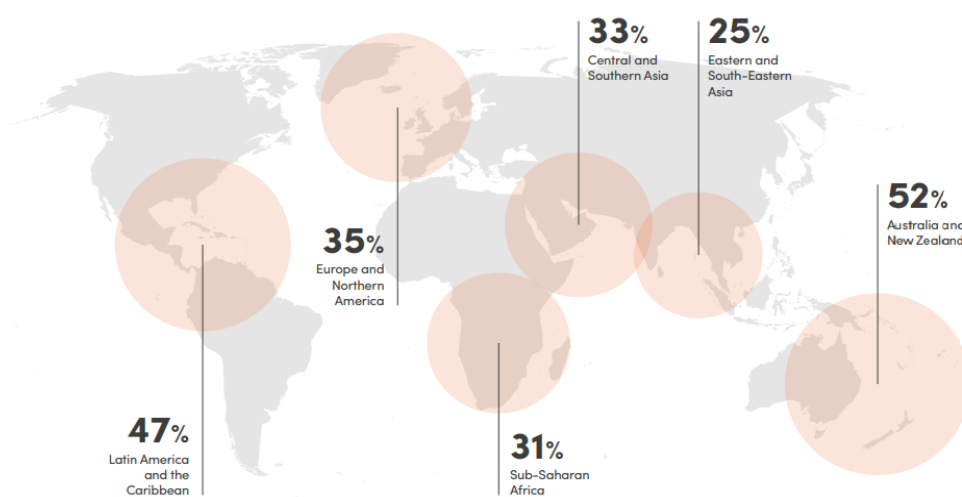
Figure 1.6: The global statistics of female researchers

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[26] UNESCO Institute of Statistics 2022(Statistical data:2019) : https://www.unesco.org/reports/science/2021/en/dataviz/share-women-researchers-radial

According to Figure 1.6, the participation of female researchers in Southeast Asia, including Sri Lanka, was reported at 25% in the 'Progress on the Sustainable Development Goals: The Gender Snapshot for 2019'.

1.3. Gender distribution of research staff by sector (based on the sectorial categorization of institute affiliations)

According to the sectoral perspectives of affiliated institutions, female researchers were most common in the social sciences, medical and health sciences, and agricultural and veterinary sciences. However, in the other two fields—natural sciences and engineering and technology—where there is a need to promote more female representation, the tendency was opposite (Figure 1.7).
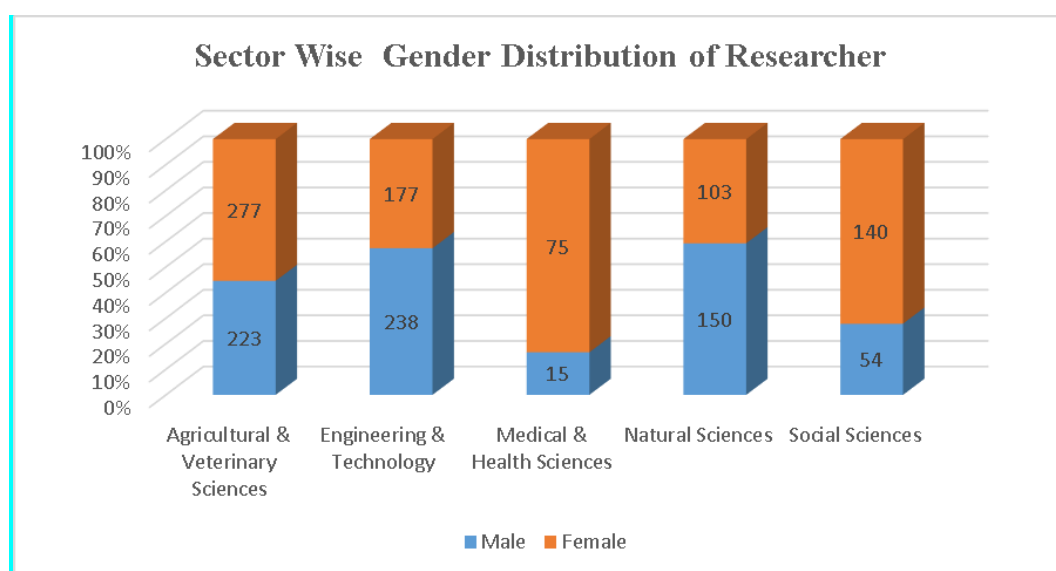
Figure 1. 4: The gender distribution of research staff in different sectors.
N: Total number of researchers=1452*

1.4. Areas of expertise of the Research staff (based on their academic disciplines).

The survey categorized the researchers' fields of specialty as Natural Sciences, Engineering & Technology, Medical & Health Sciences, Agricultural & Veterinary Sciences, and Social Sciences in accordance with OECD norms. The social sciences had the least amount of specialization (n = 17), whereas the agricultural sciences accounted for the majority of researchers (n = 441) (Table 5).

Table 5: Staff distribution for research based on expertise (academic disciplines) and gender

Field of Expertise	Male		Female		Total
Agricultural & Veterinary Sciences	185	42%	256	58%	**441**
Engineering & Technology	184	64%	105	36%	**289**
Medical & Health Sciences	10	17%	49	83%	**59**
Natural Sciences	231	41%	328	59%	**559**
Social Sciences	61	70%	26	30%	**87**
Other *	12	71%	5	29%	**17**
Total	**681**	**47%**	**769**	**53%**	**1452**

Other: Not specified*

28% of the engineering graduates around the globe were women, and as per statistics of Sri Lanka, the trend was even higher, at 31%[27,28](UNESCO Science Report 2021(Statistical data:2019); Sri Lanka University Statistics 2019-UGC).

1.5. Sectorial composition of the research staff based on the highest academic qualifications held by them.
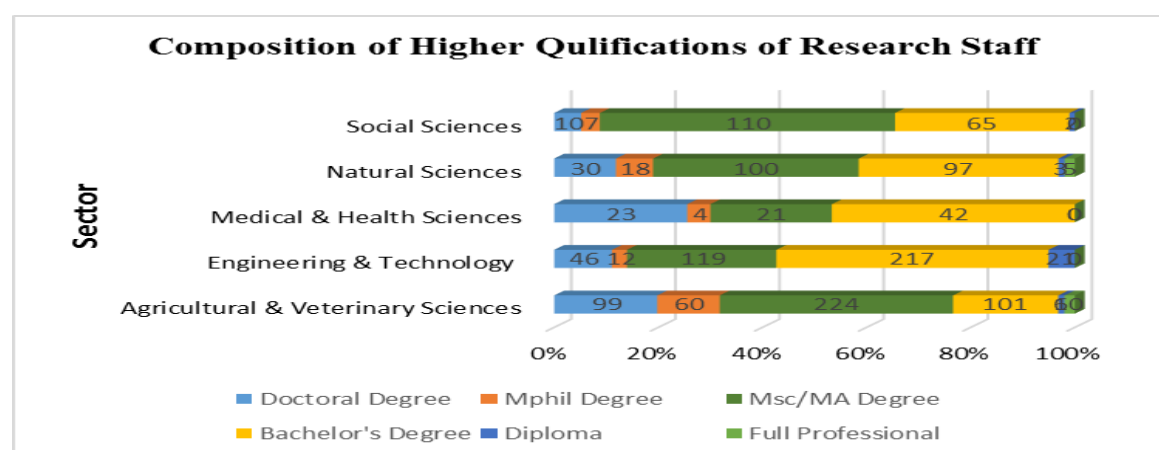
Figure 1.8: Composition of research staff based on the highest qualifications held by them (Sectorial Distribution)

[27] https://www.unesco.org/reports/science/2021/en
[28] Sri Lanka University St:atistics 2019 (UGC); https://www.ugc.ac.lk/downloads/statistics/stat_2019/Chapter4.pdf

Figure 1.8 depicts the graphical representation of the composition of the researchers' highest qualifications. Accordingly, the majority of them hold bachelors and master's degrees.

1.6.   Research staff Age distribution.

Young scientists and researchers are widely recognized as being among the most creative and energetic researchers. The young researchers can also be more mobile and better trained than ever before. They constitute a vast pool of global talent that stands to change the geography of knowledge in fundamental ways. These early-career researchers also play a central role in knowledge economies because they can be the key innovators and creators that provide the intellectual capital needed to grow a strong national research and innovation system. When viewed against the spectrum of emerging challenges faced by nations worldwide—rapid economic globalization, ageing populations, increased demand for highly skilled labor, and the expansion of systems of higher education—the necessity of nurturing and promoting young researchers seems more urgent than ever[29,30].

The sample survey shows most of the researchers were in their mid-career age group of 31–40 years (n = 503, 35%). Also, a significant representation of 20% was in the later career stage (age > 50), and only 15% of the researchers were in their early career stage, age <30 years. It urges the system to adapt sustainable recruitment and retention strategies to attract more talented young people into careers in research to ensure sustainable human resources management [31] (Figure 1.9).

[29] The Global State of Young Scientists; Global Young Academy; https://globalyoungacademy.net/wp-content/uploads/2015/06/GYA_GloSYS-report_webversion.pdf

[30]The Effects of Aging on Researchers' Publication and Citation Patterns; PLoS One. 2008; 3(12): e4048. 2008 Dec 29. doi: 10.1371/journal.pone.0004048

[31] Systematic literature review on sustainable human resource management (2019); https://doi.org/10.1016/j.jclepro.2018.10.091
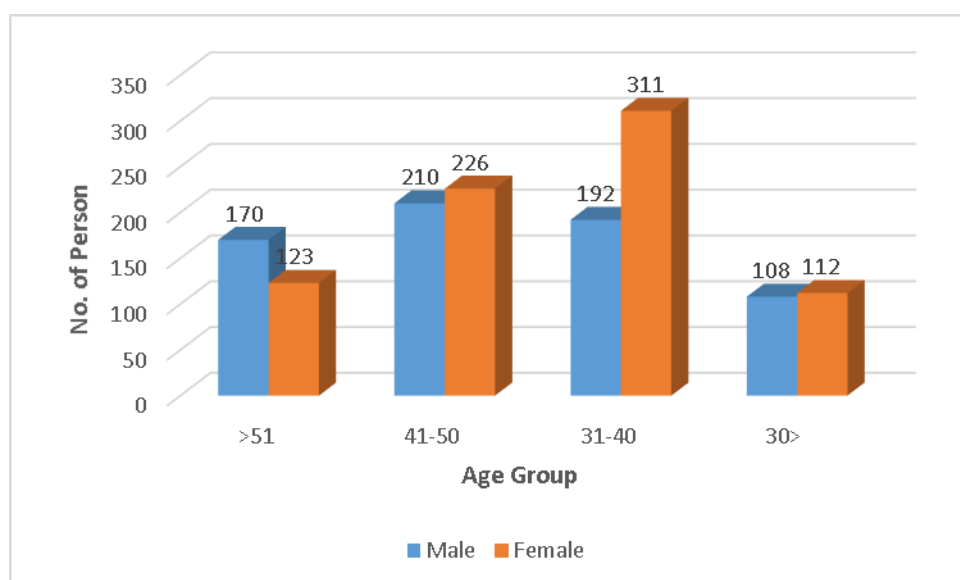
Figure 1.9: Age and gender distribution of research staff.

1.7. Highest education qualification of research staff

In this survey, the educational qualifications of the research staff that were considered PhD, MPhil, MSc/MA, BSc, and Diploma. Figure 1.10 depicts the distribution of research staff based on their highest educational qualifications.
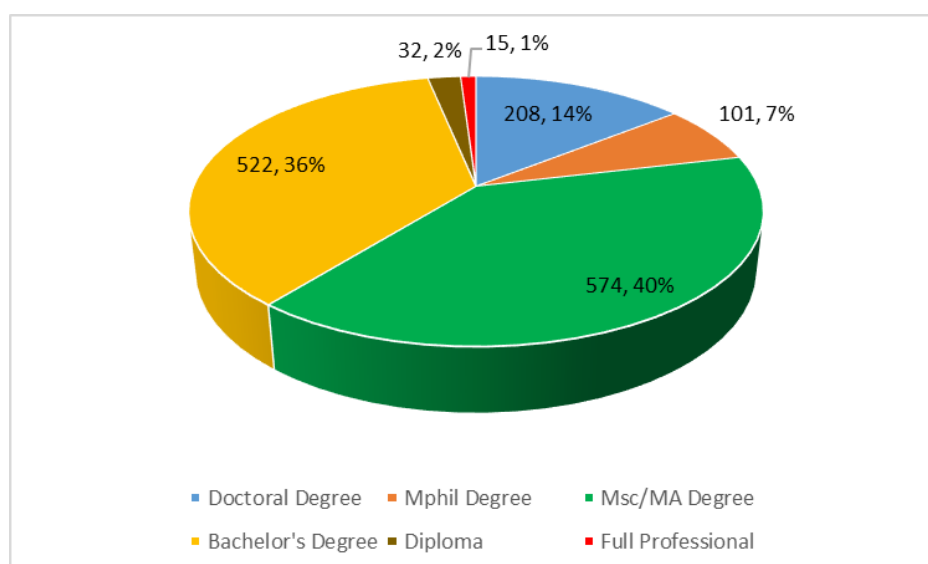
Figure 1.10: Distribution of research staff based on their highest educational qualifications.

The highest academic qualifications held by 40% of the researchers are a coursework master's degree (n = 574), while 36% of the researchers have a bachelor's degree (n = 522). Among the researchers, just 7% (n = 101) held an MPhil, 14% (n = 208) a PhD, 1% (n = 15) completed professional membership in an established chartered body, and so forth. Figure 1.11 shows the gender comparison with the highest levels of qualification.
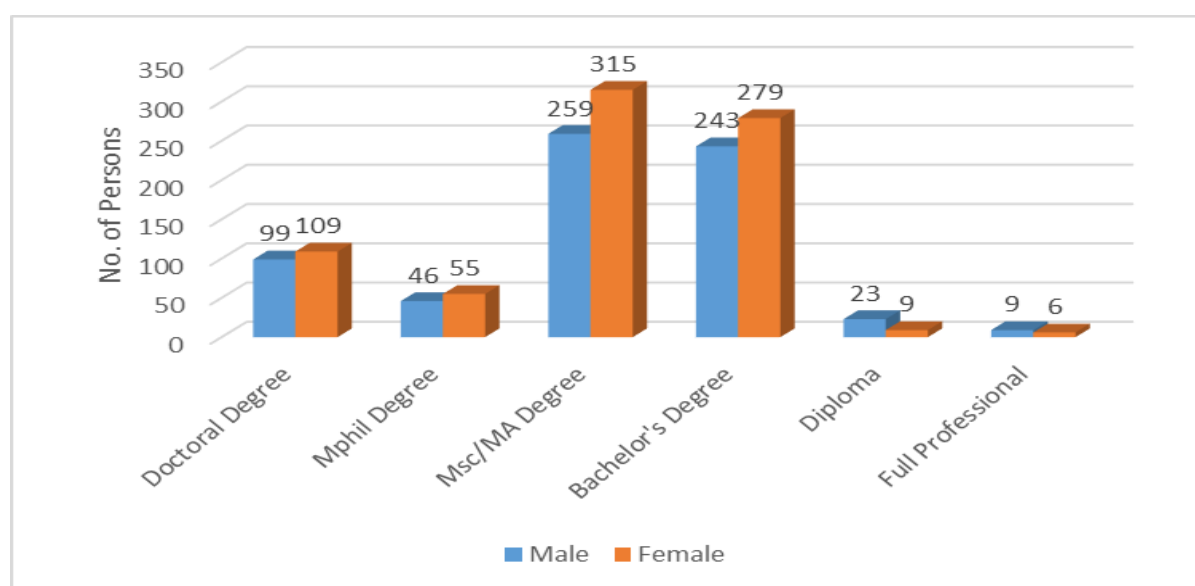
Figure 1.11: Distribution of research staff by highest level of education and gender

1.8.Human Resource Development (HRD)

1.8.1. Workshops, seminars, and conferences (local and international)

Human Resource Development (HRD) is the framework for assisting employees in developing their personal and organizational skills, knowledge, and capacities. Employee training and career development are examples of HRD opportunities. HRD of the scientific staff of the surveyed institutes was carried out in the form of workshops, seminars, and conferences. Accordingly, a total of 2409 employees participated in local and foreign training; 2109 (88%) received local training, while 300 (12%) received international training. (Fig. 1.12).
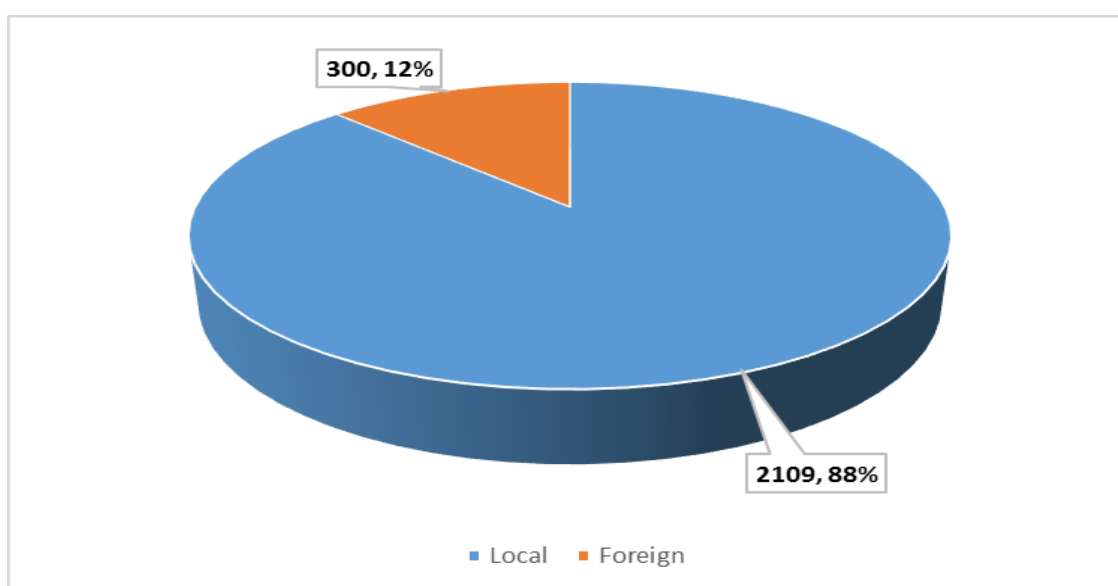
Figure 1.12: Composition of staff engaged in training programs (local and foreign)
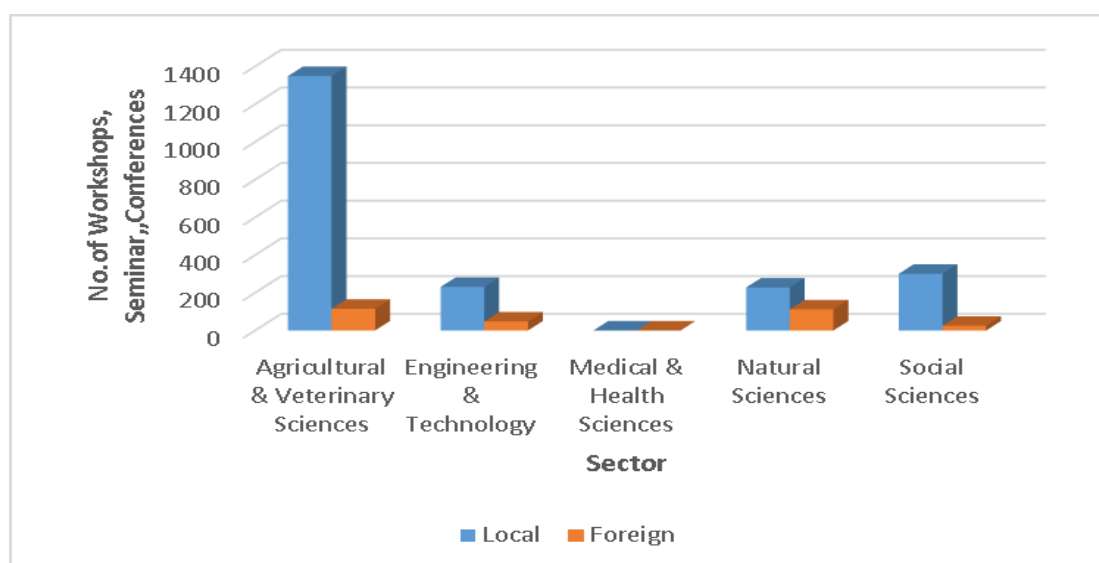
Figure 1.13: Sector-wise distribution of scientific staff participated in training programs

The trained scientific staff was comprised of researchers (n = 1049), research support personnel (n = 1338), and librarians/information officers (n = 22) (Fig. 1.14).
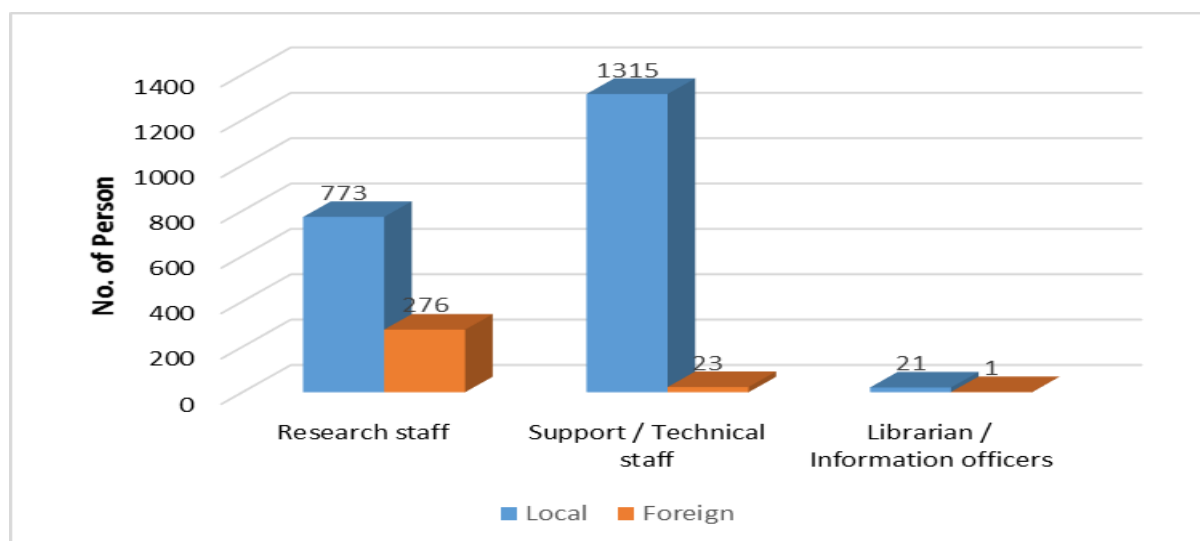
Figure 1.14: Staff that received training opportunities based on different scientific staff categories
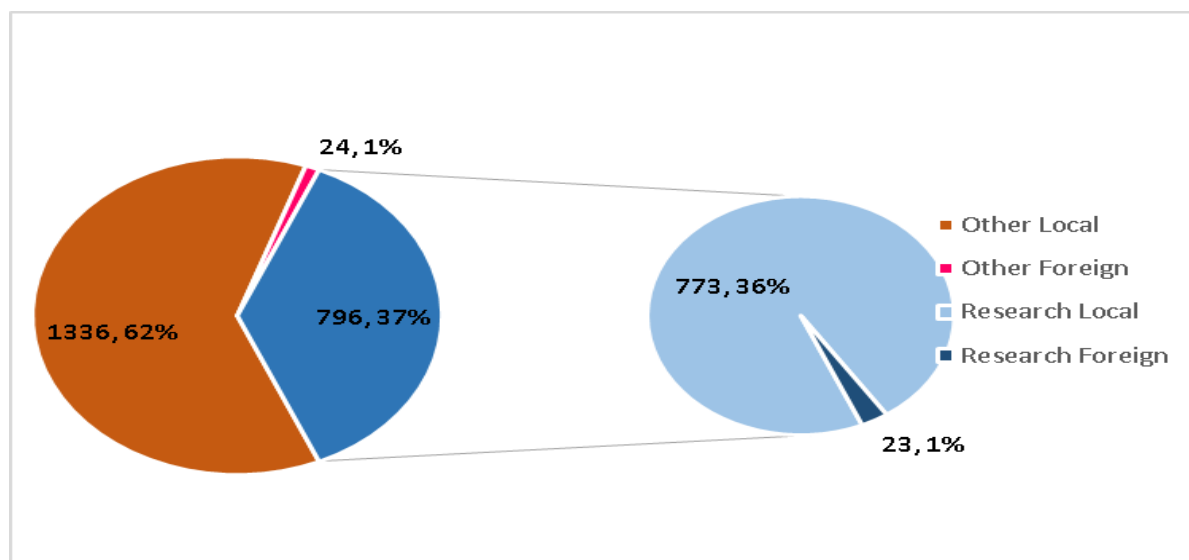
Figure 1.15: Composition of training programs by research staff & other staff

1.8.2. Employee turnover in the scientific staff

Employee turnover refers to the number or percentage of workers who leave an organization and are replaced by new employees for a defined period of time. In 2019, the S&T institutes surveyed hired 171 scientific workers, comprising 104 research staff, 62 research support staff, and 2 librarian/information officers. During the same period, 179 scientific staff left the S&T institutes, comprising 91 research staff, 87 research support staff, and one librarian/information officer. Job dissatisfaction, career advancement, retirement, switching careers, and work-life balance have been reported as the major reasons leading to global employee turnover[32]. In 2019, the scientific staff surveyed had an estimated turnover rate of between 5% and 7%, which was lower than the estimated average global rate of 10.6%[33]. The Human Flight and Brain Drain Index shows that Sri Lanka had an average value of 7.10 index points in 2019, which is extremely concerning for brain drain. It highlights how crucial it is for preventing the current higher-end brain drain.
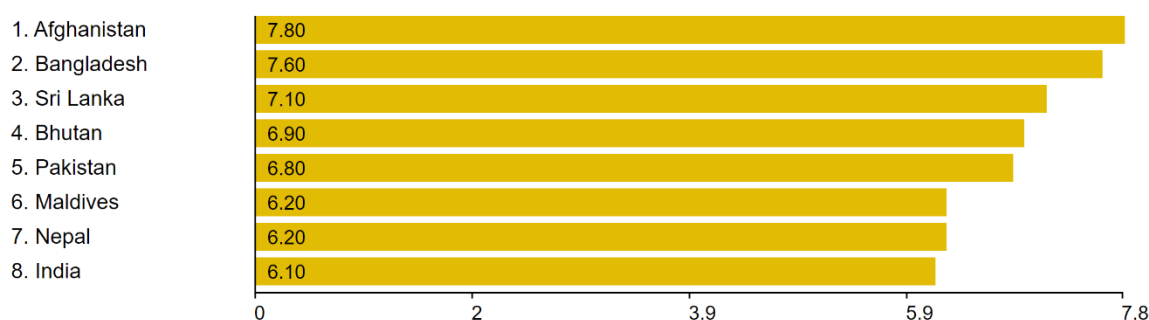
Figure 1.16: The Human Flight & Brain Drain index -2019 (comparison with SAARC countries)
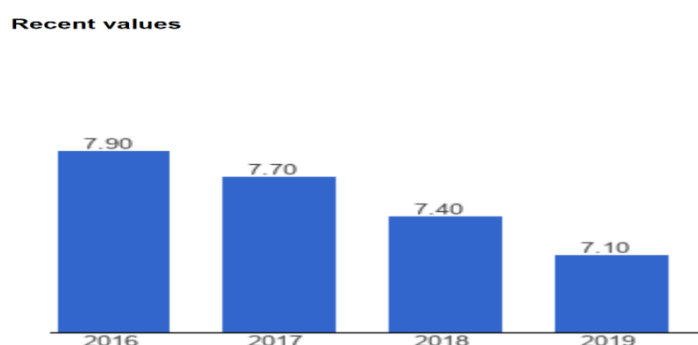
Figure 1.17: Human Flight and Brain drain Index Sri Lanka 2016-2019

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[32] https://www2.deloitte.com/content/dam/Deloitte/mx/Documents/about-deloitte/Talent2020_Employee-Perspective.pdf
[33] https://www.linkedin.com/business/talent/blog/talent-strategy/industries-with-the-highest-turnover-rates

Tables 6 and 7 illustrate the number of scientific staff hired and the number of employees who left the S&T institutes surveyed in 2019.

Table 6 : a sector-by-sector description of scientific staff recruitment

		Scientific Staff Category			Total
		Research Staff	Support/Technical Staff	Librarian /IT	
Sector	Agricultural & Veterinary Sciences	24	24	0	48
	Engineering & Technology	46	34	0	80
	Medical & Health Sciences	20	0	0	20
	Natural Sciences	14	4	2	20
	Social Sciences	3	0	0	3
Total		107	62	2	171

Table 7 : Sector-by-sector description of the scientific staff left

		Scientific Staff Category			Total
		Research Staff	Support/Technical Staff	Librarian /IT	
Sector	Agricultural & Veterinary Sciences	32	38	1	**71**
	Engineering & Technology	36	26	0	**62**
	Medical & Health Sciences	1	1	0	**2**
	Natural Sciences	18	11	0	**29**
	Social Sciences	4	11	0	**15**
Total		91	87	1	179

50%

Share of Sri Lankan emigrants with PhD,

Raising concerns about brain drain

(Source: UNESCO Science Report 2021- South Asia[34])

Employee Turnover

EMPLOYEE TURNOVER ESTIMATED (RESEARCHERS) RATE IN 2019= 6%

Average global employee turnover =10.6% (source: LinkedIn)

[34]https://www.unesco.org/reports/science/2021/en/south-asia

1.8.3. *Funding for higher studies*

The number of scientific staff who were offered funds for higher studies by their institutions is given in Table 8.

Table 8: Sector-by-sector illustration of studies funded by the institutions.

Sector		Degree funded by the institution					Total
		PhD	M.Phil.	MSc/MA	Postgraduate Diploma	Training attachments	
	Agricultural & Veterinary Sciences	12	8	7	0	6	**33**
	Engineering & Technology	2	1	5	1	0	**9**
	Medical & Health Sciences	0	0	0	0	0	**0**
	Natural Sciences	8	25	8	0	0	**41**
	Social Sciences	0	0	2	0	0	**2**
Total		**22**	**34**	**22**	**1**	**6**	**85**

In 2019, a total of 85 scientific staff were funded by their affiliated institutions to pursue postgraduate studies. These included one postgraduate diploma, 22 MSc degrees, 34 MPhil degrees, and 22 Ph.D. degrees. The highest number of degrees offered to employees was from the Natural Sciences sector (n = 41).

1.8.4. *Incentives for the scientific staff*

Incentives provided to the staff by the institution have benefits for both employees and employers. When recognized for stellar performance and productivity, employees have increased morale, job satisfaction, and involvement in organizational functions. As a result, employers experience greater efficiency and an increase in productivity. It also assists in retaining qualified employees within the institute. Table 9 indicates the incentives given to the scientific staff of the institute. Transport facility/allowance and professional allowance were the most common incentives offered by the institutions, followed by medical insurance, housing/quarters, and research allowance.

Table 9: Perks given to the scientific staff of S & T institutions.

Perks	No. of institutions
Research allowance	16
Medical insurance	26
Transport facility/allowance	28
Professional allowance	32
Housing/Quarters	19
Other	6

2. PHYSICAL RESOURCES

2.1. Infrastructure facilities

Basic infrastructure is the set of facilities essential to the functioning of an institute. It includes laboratories, libraries, auditoriums, workshops, scientific instruments, equipment, libraries, archives, and ICT facilities such as networks, databases, the internet, servers, and computers.

Table 10 indicates the common infrastructure facilities available in the surveyed institutions.

Table 10: Basic infrastructure facilities available in S & T institutions

Sectors	Labs	Workshops	Auditorium/CH	Library	CIF	Other
Agricultural & Veterinary Sciences	100	10	44	20	11	53
Engineering & Technology	121	11	13	5	13	11
Medical & Health Sciences	21	0	4	2	0	0
Natural Sciences	75	6	15	12	0	0
Social Sciences	7	9	9	2	0	3
Total	**324**	**36**	**85**	**41**	**24**	**67**

Common infrastructure considered in the survey included laboratories (n = 324), workshops (n = 36), auditoriums (n = 85), and libraries (n = 41). The "other" infrastructure (n = 67) included regional offices, circuit bungalows, mobile labs, instrument rooms, training rooms, pilot plants, engineering museums, technology parks, plant nurseries, cropping houses, screening houses, insect museums, early warning centers, pest control farms, plant houses, sprinkler irrigation systems, experimental farms, feed mills, disease-free poultry houses, and animal houses.

2.2. IT-related facilities

All 42 institutes have institutional websites and internet facilities. Only 26 of them have a database on research and services. Table 11 depicts the institutes' IT infrastructure.

Table 11: Number of Institutes with IT-related facilities

Sectors	Website	DBMS	Internet	Free Online Journal	Other
Agricultural & Veterinary Sciences	19	13	19	5	1
Engineering & Technology	7	2	7	3	1
Medical & Health Sciences	2	1	2	0	0
Natural Sciences	8	7	8	3	0
Social Sciences	5	3	5	2	1
Total	**41**	**26**	**41**	**13**	**3**

2.3 ICT resource

Table 13 illustrates the availability of basic ICT facilities to scientific and non-scientific cadres. The total number of personal computers used by scientific and nonscientific staff was 1593 and 2174, respectively. Overall, the non-scientific staff had access to more ICT facilities than the scientific staff.

Table 12 : ICT facilities available in S & T institutions in 2019

Sectors	Computer_Central		Computer/Laptops		Printer		Scanners		VCQ		Other	
	Scientific	Non-scientific staff	Scientific	Non-scientific staff	Scientific	Non-scientific staff	Scientific	Non-scientific staff	Scientific	Non-scientific staff	Scientific	Non-scientific staff
Agricultural & Veterinary Sciences	320	156	452	185	311	150	74	57	21	4	88	24
Engineering & Technology	500	210	499	217	190	129	34	36	1	7	10	15
Medical & Health Sciences	21	42	11	0	15	12	2	4	0	0	0	0
Natural Sciences	113	104	394	322	182	122	26	43	4	1	15	1
Social Sciences	81	46	62	32	49	30	6	6	4	0	19	6
Total	**1035**	**558**	**1418**	**756**	**747**	**443**	**142**	**146**	**30**	**12**	**132**	**46**

3. RESEARCH PLANNING

3.1 The Planning of Research Projects in relation to National Policies and Strategies

Considering the planning of R & D activities by the institutes, the source documents referred to in the preparation of the annual action plan of the institute were queried. In this regard, the documents considered were the National Science and Technology Policy, the National Research and Development Framework (NRDF), developed by NASTEC; and sectoral master plans/strategies relevant to the respective line ministries/authorities.
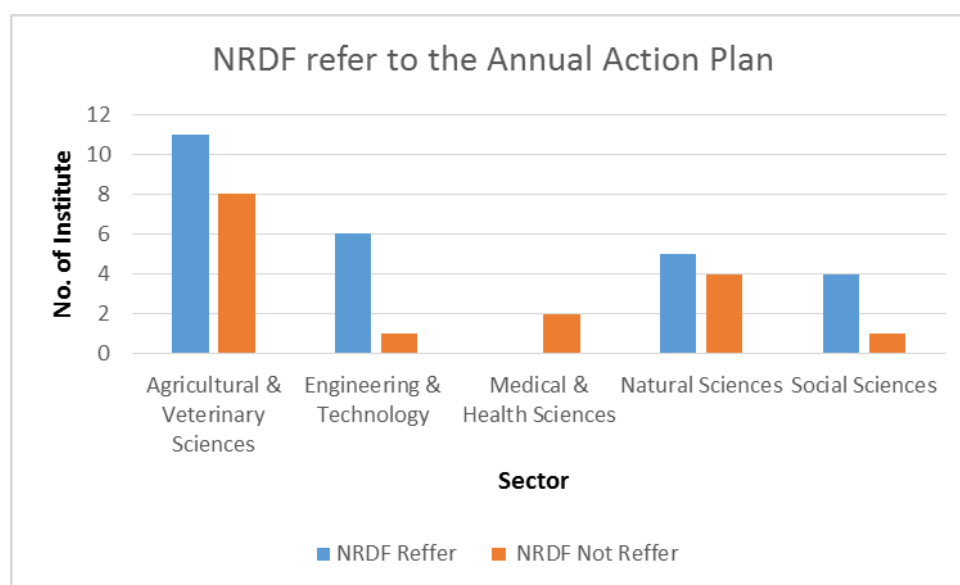
Figure 3.1: The National Research and Development Framework (NRDF)
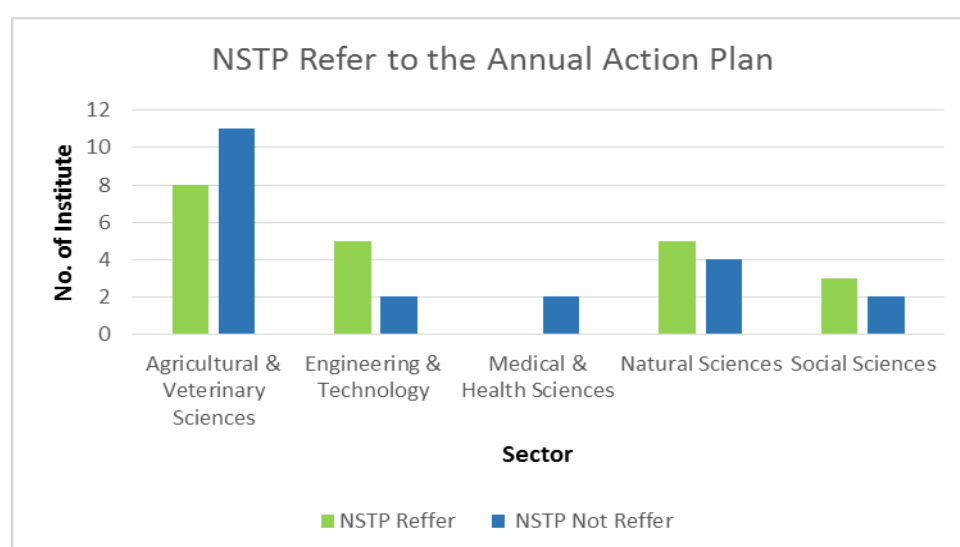
Figure 3.2: National Science & Technology Policy (NSTP) refer to the Annual Action Plan

The NRDF is a comprehensive, cabinet-approved R&D framework that guides the scientific and technological community to align their research and development activities in the country in line with national priorities. The framework identifies 10 focus areas that need immediate R&D interventions through a 10 x 10 matrix of a hundred possible combinations of them. The focus areas are as follows: (1) Water; (2) Food, Nutrition, and Agriculture; (3) Health; (4) Shelter; (5) Environment; (6) Energy; (7) Mineral Resources; (8) Apparel Industry; (9) ICT and Knowledge Services; and (10) Basic Sciences, Emerging Technologies, and Indigenous Knowledge. The ten interventions are: (1) policy formulation; (2) pure and applied research; (3) promotion of innovation; (4) application of nanotechnology; (5) application of biotechnology; (6) application of indigenous knowledge; (7) testing, standardization, accreditation, and assurance of intellectual property rights (IPR); (8) capacity building; (9) application of information communication technologies (ICT); and (10) popularization[35].Since 2017, many state-funded research and development institutes have widely considered NRDF programs to prioritize research fund allocation to institutes and projects.

Of the 42 institutes surveyed, 26 institutions (62%) referred to the interventions and strategies focused on in the NRDF, and 21 institutes (50%) aligned with the areas recommended in the National Science and Technology Policy while incorporating the R&D activities into their annual action plans. Figure 3.1 shows a snapshot of the number of institutes with respect to the sectors carrying out the interventions related to the focus areas of NRDF.

The target areas of food, nutrition, and agriculture saw the greatest number of NRDF interventions in 2019, followed by the environment, basic sciences, emerging technologies, and indigenous knowledge.

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[35] National Research and Development Framework (2016); http://www.nastec.gov.lk/reports/nrdf
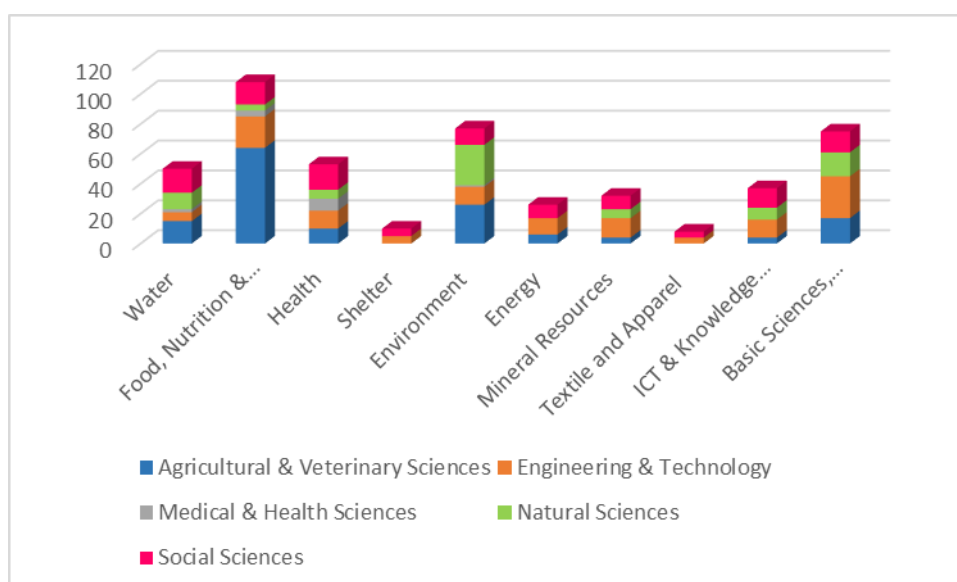
Figure 3.3: Institutes carrying out Interventions related to the NRDF's 10 Focus Areas

3 .2. Other Source Documents

The National Agriculture Research Policy in the agriculture sector, the Forest Policy in the forest department, the Mines and Minerals Act by the Geology Survey and Mineral Resources Bureau, etc., are examples of policy directives and specifications that, in addition to the NRDF, generally guided the action plans of the relevant institutes while incorporating the R & D activities into the action plans.

4. RESEARCH FUNDING

A country's R&D sector benefits not only science and technology but also every other industry, resulting in a stabilised and developed economy overall. When a country decides to increase its spending on the R&D sector, it paves the way for long-term success. Additionally, with advanced R&D accomplishments, such nations earn global attention and reputation, which creates added advantages for their citizens.

Most of the time, a nation's economy and R&D are intertwined. As in, there are often situations where a specific R&D incentive is a phase of a government action plan that has been devised as an initiative for the country's economic growth. Accordingly, government as well as non-government organisations in most of the countries have expanded their investments in R&D. However, the USA and China have made the largest contributions to global R&D spending, and that value is roughly US $1.7 trillion[36]. When cutting-edge R&D discoveries eventually come to life and get commercialised, they have the potential to substantially improve the lives of people worldwide, especially those who are most in need globally.

The institutes acquired funding from different sources, such as the Treasury, the National Science Foundation, the National Research Council, foreign grants, and others. Funds received were categorised into four groups based on the nature of the activities for acquisition: 01) for research projects; 02) for science popularisation activities, which include conducting workshops and seminars; 03) funds for infrastructure improvement, including the purchase of laboratory equipment, construction of buildings, renovations, purchasing of land, vehicles, buildings, etc.; and 04) for other activities. In figure 4.1, the pie chart depicts the fund disbursement to the activities for utilization.

In 2019, the S&T institutes surveyed received LKR 4216.72 million from the source of funders, of which LKR 3919.94 million (93%) was spent. The highest fund covered the direct cost of the research projects (LKR 2179.81 million, 56%), followed by the indirect cost of improving the institute's infrastructure facilities (LKR 1166.67 million). The Treasury was the main funding source for those activities. The sector of Agricultural and Veterinary Sciences received the highest funding for research projects (LKR 1094.017 million). Table 14 shows the fund utilisation by different sections, and Table 15 shows funds provided by various funding sources.

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[36] UNESCO institute for statistics, 2020/08
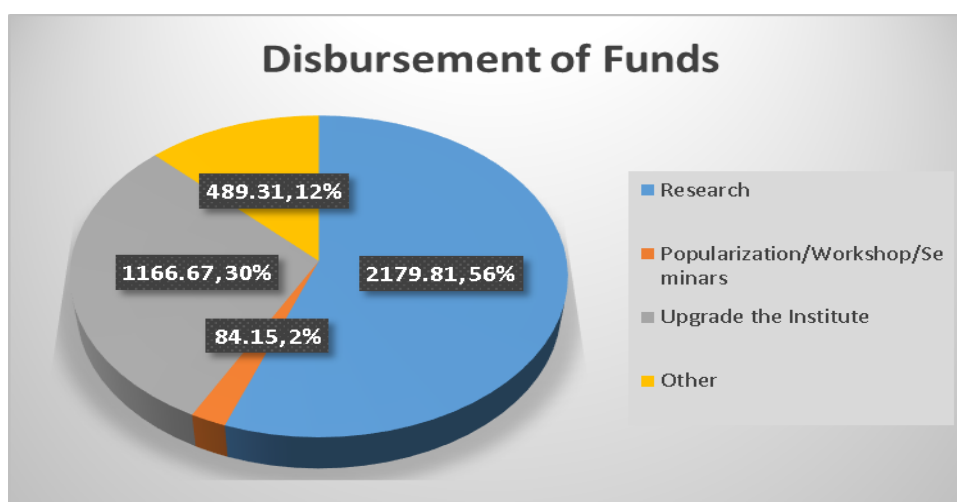
Figure 4.1: Disbursement of funds

Table 13 : Funds received and spent for projects: distribution among identified sectors

Sector	Funds Allocated / Rs. Mn.	Funds Spent / Rs. Mn.	% Utilization
Agricultural & Veterinary Sciences	1652.56	1633.93	99%
Engineering & Technology	898.53	*1011.2**	
Medical & Health Sciences	25	22.35	89%
Natural Sciences	1220.95	790.67	65%
Social Sciences	419.68	*461.57**	
Total	**4216.72**	**3919.74**	**93%**

Table 14: Funds received and spent for projects by different funding source

Funding source	Funds Allocated / Rs. Mn.	Funds Spent / Rs. Mn.	% Utilization
Foreign	243.26	222.89	92%
Multilateral	18.48	18.48	100%
NRC	95.56	*168.44**	
NSF	29.85	*37.52**	
Other	475.50	98.91	21%
Private sector	1.74	*1.76**	
Direct Treasury vote	3352.33	*3371.73**	
Total	**4216.72**	**3919.74**	**93%**

*The prior financial committed allocation, which the data on spending reveals is slightly larger than the received amount from the funders, accounts for a small fraction of the funds used in the reporting year.

Figure 4.2 depicts the funds received for research projects in different sectors and their utilization.
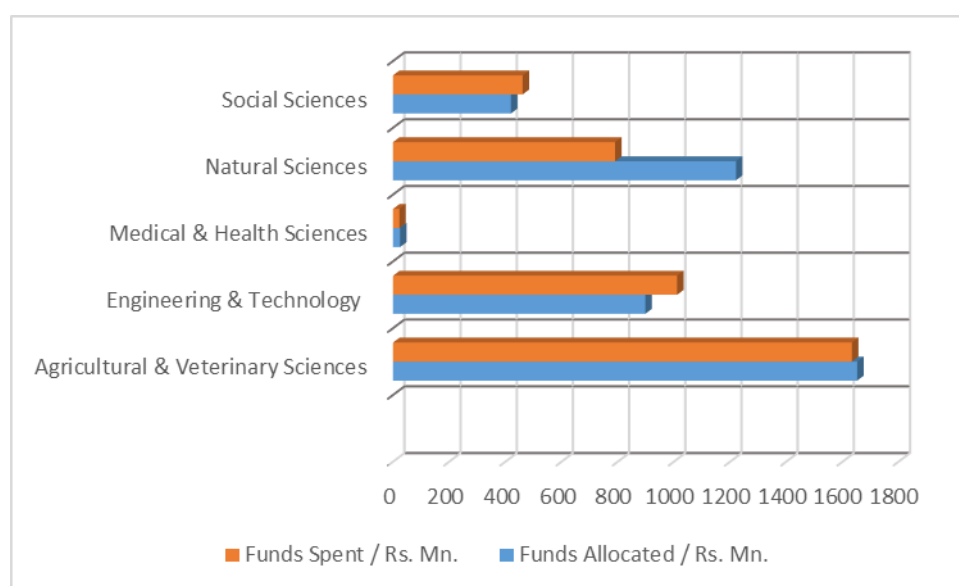
Figure 4.2: Funding for research projects, broken down by sector.

In 2019, the institutes surveyed received a sum of LKR 85.84 million for science popularization-related activities, workshops, and seminars; LKR 1498 million to upgrade the infrastructure facilities; and LKR 484.67 million to conduct activities other than the above, respectively. Of the funds received, LKR 84.15 million (98%) for popularization work, LKR 1166.67 million (78%) for upgrading the infrastructure facilities, and LKR 489.31 million (100%) for other activities were spent, respectively, by the institutes. The activities related to the upgrade of the institution include the purchase of laboratory equipment, the construction of buildings, and the acquisition of land, vehicles, and properties.

Figures from 4.2 to 4.5 indicate the amounts of funding received and spent for different activities by the institutes.
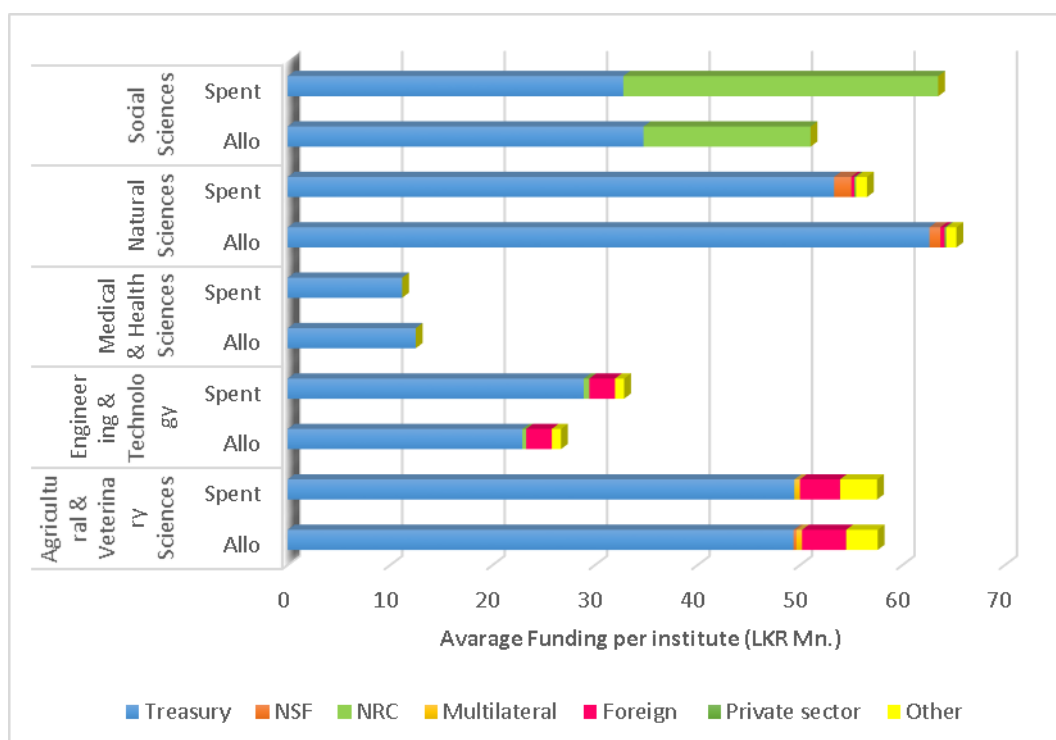
Figure 4.3: Funds received and spent by S&T institutions for different activities
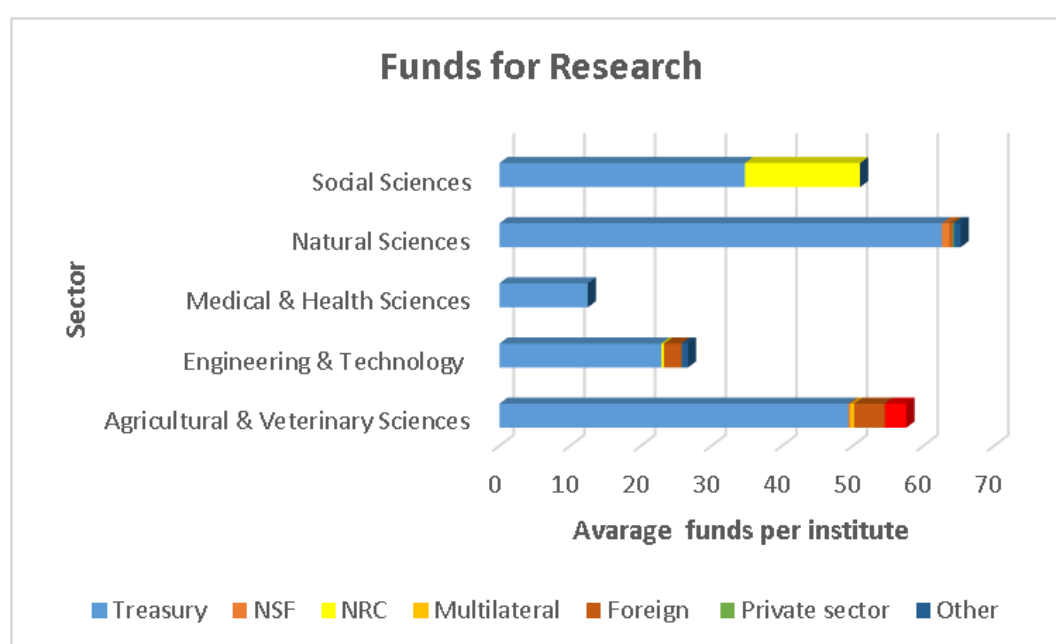
Figure 4.4: Funds received for research projects from different funding sources
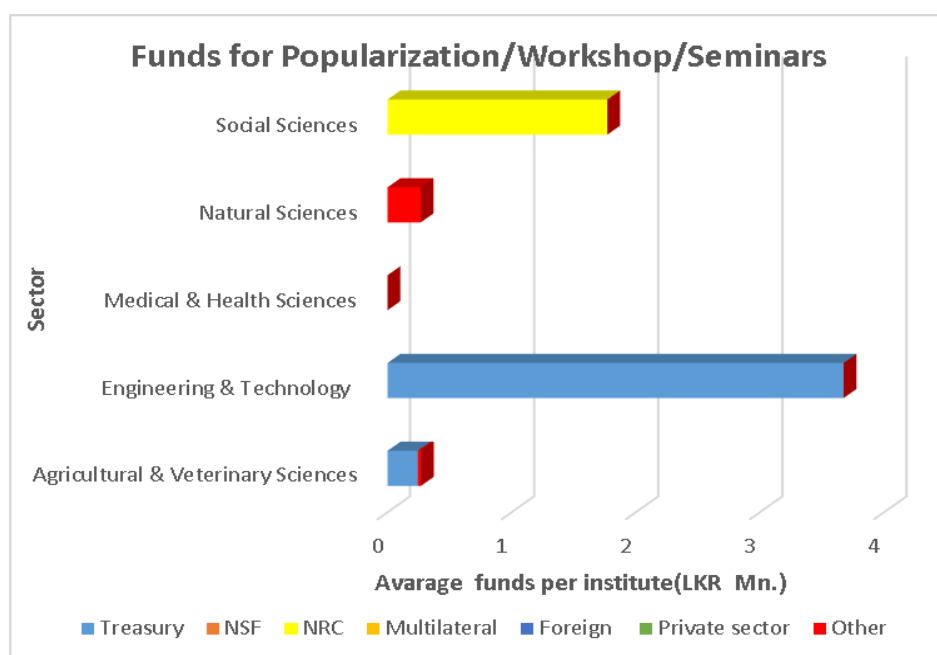
Figure 4.5: Funds received from various funding sources for science popularization, workshops, and seminars.

Trends in research funding at public-sector institutes (distributed by the institute), 2012-2019

Based on the sample survey data from 2012 to 2019, a slight upward trend in research funding per institute with a remarkable increase in 2014 and a decline in 2015 has been noted (see Fig. 4.6).
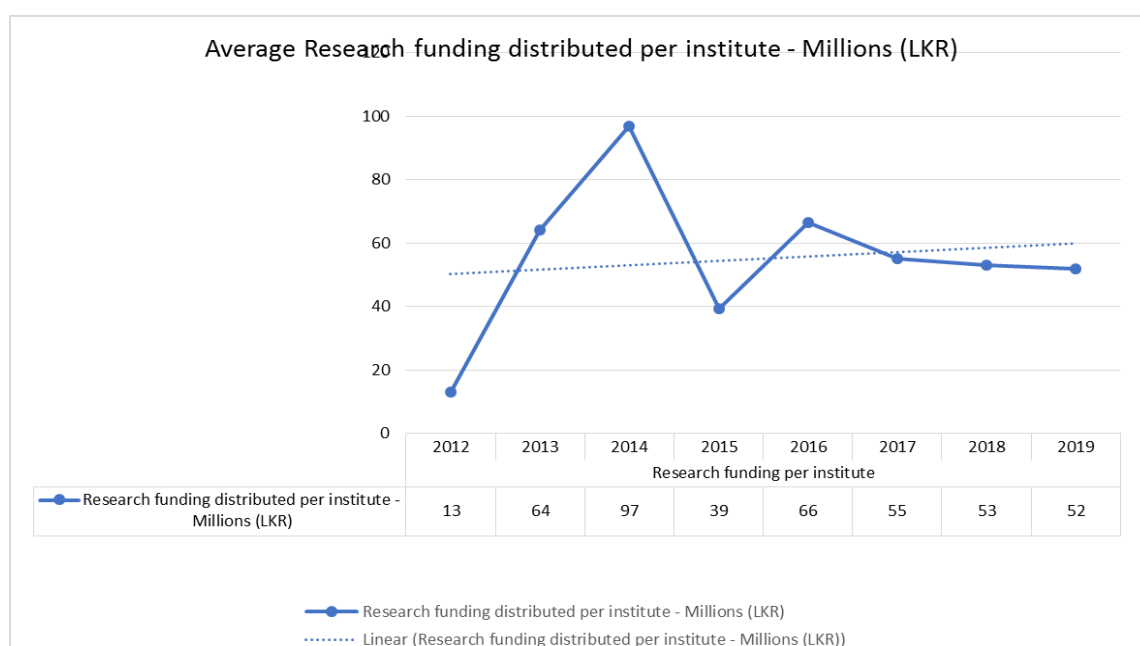
Figure 4.6: Research funding per institute.

Return on R & D Investment.

According to the statistics of the National Science Foundation, USA, global investment in R&D for 2019 has tripled compared to the year 2000, and the value for 2019 was estimated at $2.4 trillion. The annual rise in total global R&D averaged 6.9% over the 2000–10 period and 6.2% for 2010–19[37,38] .The South Asian regional statistics illustrated in figure 4.7 show a recognizable upward trend of 10% and 9% from 2000–2010 and 2010–2019, respectively. For the same period in Sri Lanka, it has been noted as a downward trend, with a decrease of 37% compared to the previous year[39,40,41] .

Global R&D expenditures, by region: 2000, 2010, and 2019
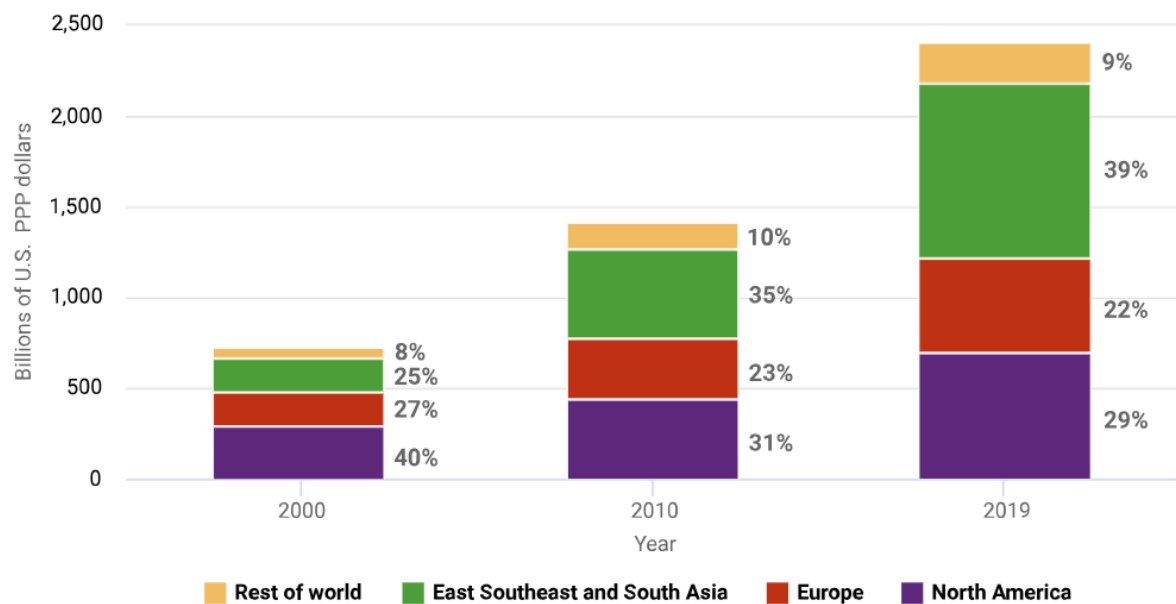
Figure 4.7: Global R & D expenditure based on regions (Image Credit: Science and Engineering indicators, NSF, USA)

[37]https://ncses.nsf.gov/pubs/nsb20221/u-s-and-global-research-and-development

[38] https://www.ncses.nsf.gov/pubs/nsb20225/cross-national-comparisons-of-r-d-performance

[39] Sri Lanka GDP per Capita PPP, World Banks:
https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD?end=2020&locations=LK&start=2000&view=chart

[40] Annual Reports , 2019 , Ministry of Finance ; https://www.treasury.gov.lk/api/file/72faa85f-5ea8-426b-9b3a-5ab6f3002752

[41] The World bank data- https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS

GDP per capita, PPP (current international $) - Sri Lanka

International Comparison Program, World Bank | World Development Indicators database, World Bank | Eurostat-OECD PPP Programme.
License : CC BY-4.0 ⓘ
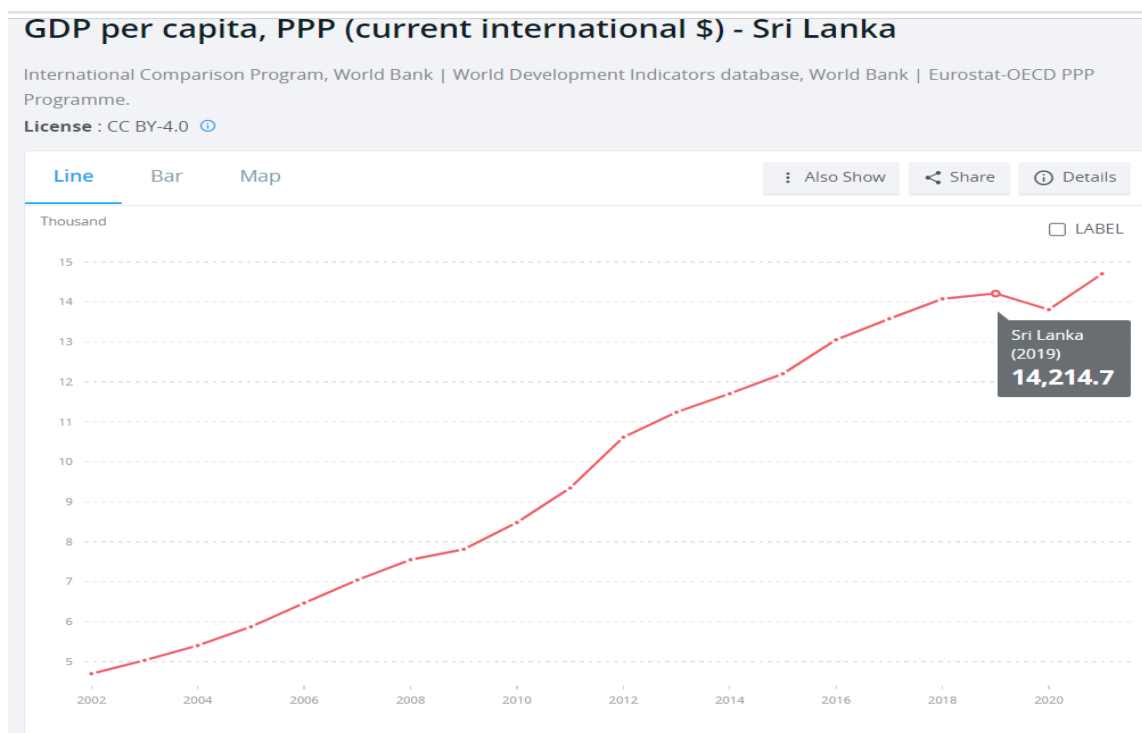
Figure 4.8: Sri Lanka GDP per capita PPP 2000-2019 (Source; World Bank)

5. RESEARCH OUTPUTS

5.1. Research projects

In 2019, the institutions surveyed carried out 748 research projects (Annexure 3), with a completion rate of 21 %(n=157), and most of them were multi-year projects initiated in the year before the reporting year. Figure 5.1 depicts the sectorial representation of research projects.
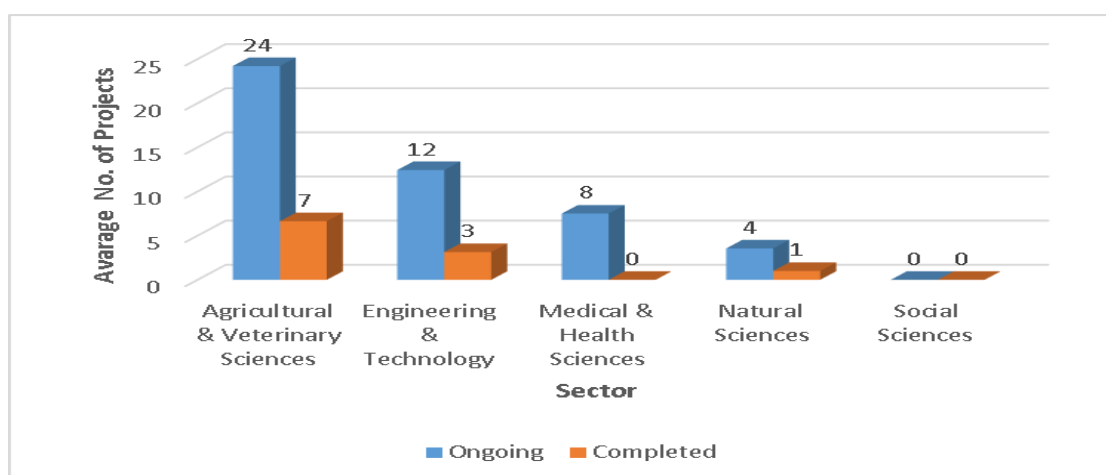
Figure 5.1: Research projects conducted by S & T institutions in 2019

The sector of Agricultural and Veterinary Sciences (n = 586, 78%) carried out the highest number of research projects, of which 460 were ongoing and 126 were completed in the fiscal year. The average number of projects per institute was also high in the sector of agricultural and veterinary sciences. Among the sectors, the highest number of research projects were carried out by the Rice Research & Development Institute (RRDI) (n = 229, 30.5%), followed by the Coconut Research Institute (CRI) (n = 64), and Tea Research Institute (TRI) (n = 62).

5.2 Contributions to the UN's sustainable development agenda through intended project activities

Countries are coping with a number of problems, including climate change, poverty, and growing urbanization, as the world population is expected to surpass nine billion by 2050. Every member nation is dedicated to achieving national targets in every context of society by utilizing innovation, know-how, technology, and financial resources. This commitment stems from the UN agenda's universal call to action to end poverty, safeguard the environment, and ensure that all people enjoy peace and prosperity. Therefore, in order to accomplish these objectives at the national level, all the state institutions should know clearly about accountability, which could be reflected in their R&D activities aimed at contributing to the National SDG Commitments.

According to the survey, a substantial number of projects planned under the R&D of the institutions were integrated to contribute to such commitments. A snapshot of initiatives integrated with the institutional action plans is depicted in Figures 5.2 and 5.3. The most such

initiatives (n = 31, 16%) were targeting the SDG's Zero Hunger, followed by Industry, Innovation, and Infrastructure (n = 25, 13%), and so on.

Another important universal call of the Paris Agreement on Climate Change is a framework comprised of multiple development initiatives that aim to address one of the key basic concerns of the twenty-first century: global warming and climate change[42]. Being a country with tropical climatic patterns vulnerable to extreme conditions such as droughts and floods, Sri Lanka adopted a number of measures to address climate action at the national level in line with the pact. In this regard, Sri Lanka has developed a national climate change policy, and accordingly, new initiatives are being suggested to adapt to and mitigate adverse climatic conditions, leading to sustainable economic development[43]. One such initiative is the GCF-funded climate adaptation project, which aims to increase farmers' resilience to climate variability and extreme events[44]. In addition, there are 47 other climate change initiatives funded by the Global Environment Facility (GEF) that are currently under implementation in Sri Lanka[45].However, this survey is not particularly intended to catch on in this regard from the institutional perspective, and in the future, repot is intended to cover them.

Figure 5.2: Line of Sight -Number of Research Projects (planned) in Alignment with SDGs.

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[42] https://unfccc.int/process-and-meetings/the-paris-agreement
[43] http://www.climatechange.lk/CCS%20Policy/Climate_Change_Policy_English.pdf
[44] https://www.adaptation-undp.org/sites/default/files/resources/project_proposal_gcf_undp_srilanka_final.pdf
[45] https://www.thegef.org/projects-operations/country-profiles/sri-lanka
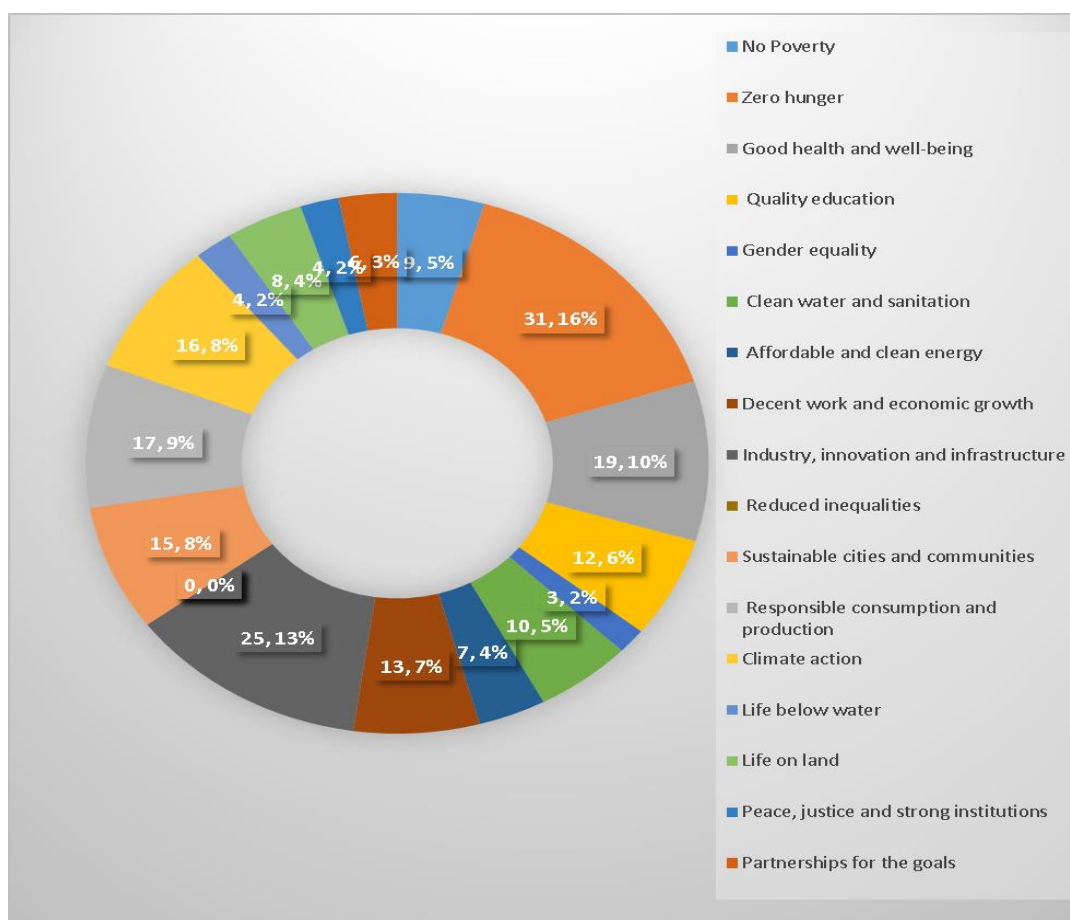
Figure 5.3: Line of Sight of Intended Project Contributions to SDGs

5.3 New products, processes, or technologies created as a result of research

Through their research projects, S&T institutes developed 50 new products, 25 new processes, and 29 new technologies during the year 2019 (Annexures 4–6). Figure 5.4 indicates the sector-wise development of products, processes, and technologies.
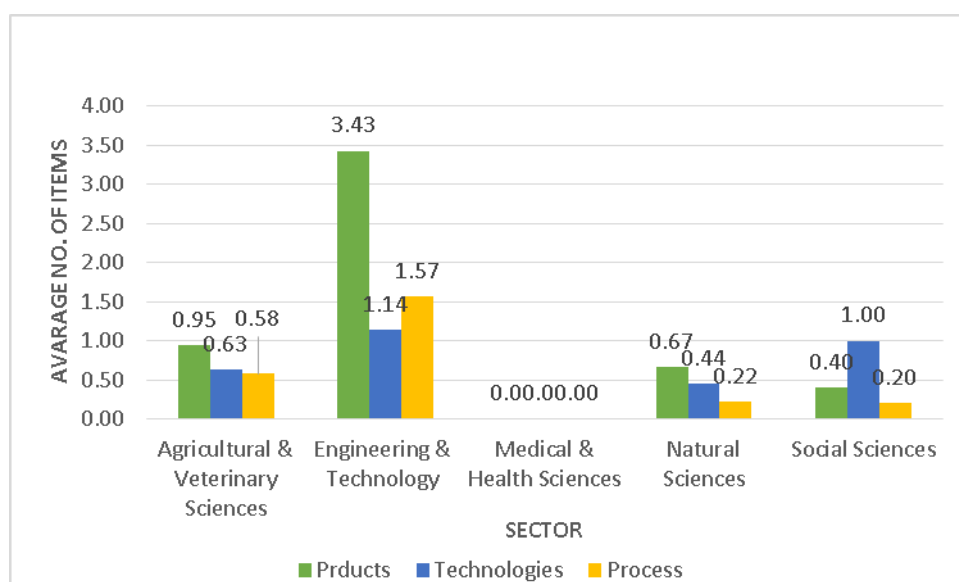
Figure 5.4: Development of new processes, technologies, and products in 2019.

5.4 Trend in research output (products-processes-technologies developed) across public sector institutes (distributed per institute), 2012-2019

As shown in the graph below, the number of product-process-technologies developed per institution fell over an eight-year period from 2012 to 2019.
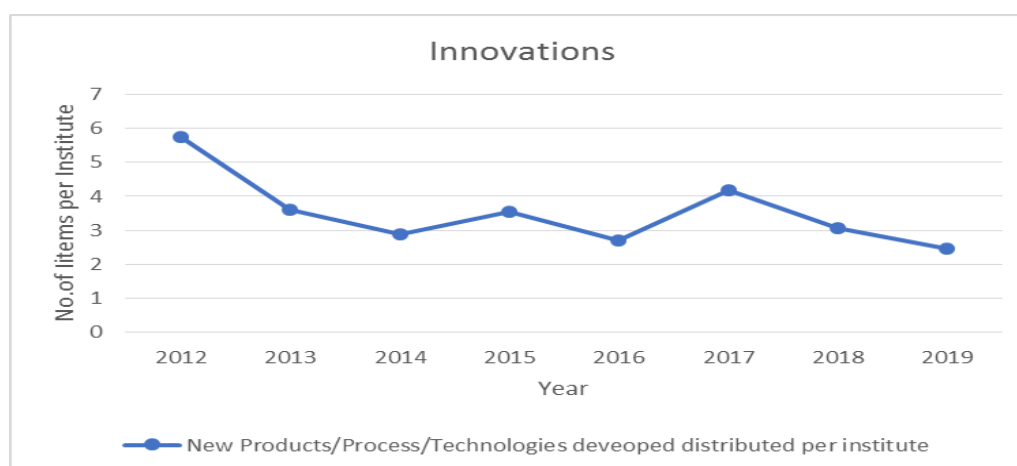
Figure 5.5: New products, processes, or technologies developed by the institutes surveyed between 2012 and 2019.

5.5 Number of Publications

There has been a tremendous increase in the number of research publications worldwide over time. According to the UNESCO science report for 2021, global output increased by 21% between 2015 and 2019, and environmental science, robotics, artificial intelligence, energy,

and materials science were recognised as the primary areas of research. In South Asia, India stands out as a major research publishing country, with approximately 118 publications per million population, while Sri Lanka is placed third, with 100 publications per million population. Not only the research's main output but also the by-products were communicated via plenty of quality scientific outlets, such as full research articles in indexed journals, articles in refereed journals, extended abstracts, conference proceedings, monographs, books, and chapters in books, bulletins, newsletters, magazines, and working papers, to name a few. The number of publications by the institutions surveyed in 2019 is given in Table 15.

Table 15: Various scientific publications produced by S&T institutions in the year 2019

Sector	No. of Publications n(b*)								Total
	SCI Journals	SCI extended journals	Refereed Journals	Abstracts of papers presented at conferences/symposia	Monographs	Books	Chapters in Books	Other	
Agricultural & Veterinary Sciences (19)	15	2	50	181	0	1	4	137	390
Engineering & Technology (7)	12	13	23	156	5	0	4	12	225
Medical & Health Sciences (2)	0	8	7	21	3	0	0	0	39
Natural Sciences (9)	26	33	21	156	0	1	10	64	311
Social Sciences (5)	39	0	9	222	1	7	0	22	300
Total	**92**	**56**	**110**	**736**	**9**	**9**	**18**	**235**	**1265**

In total, these institutions published 1265 works in various scientific outlets. The majority of them were research abstracts (n = 736) that were conference proceedings. The highest number of publications were from the Agricultural and Veterinary Sciences sector (n = 390) and the Natural Sciences sector (n = 311).

5.6 Trend in Research Publications (Distributed per institute), 2012-2019
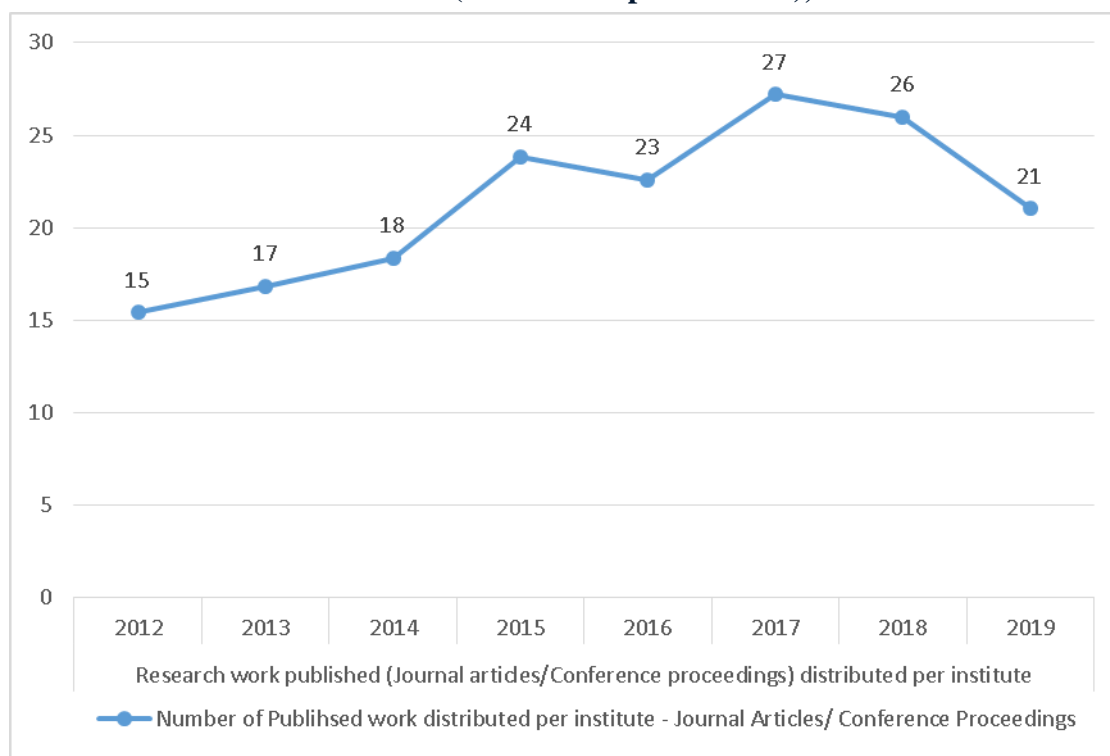
Figure 5.6: Per institute, research work is published and distributed.

(*Only the number of published articles in the Journals and the Conference proceedings were considered in this analysis)

5.7 Number of Scholarly publications per unit GDP and GERD- Regional, world comparison with Sri Lanka
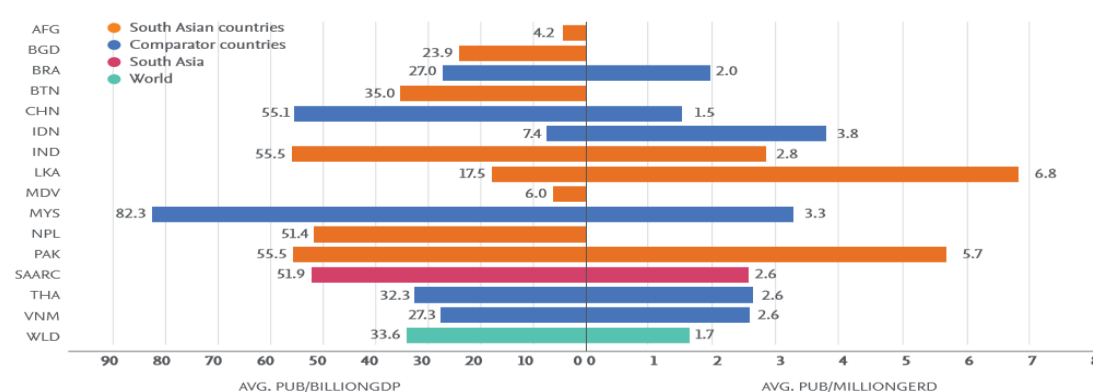
Figure 2
Number of scholarly publications per unit GDP (lhs) and GERD (rhs), South Asian countries and global comparator countries, 2012-2016. Sources: World Bank, UNESCO, and Scopus®

Figure 5.7: Regional, world comparison with Sri Lanka(Image Credit: South Asia; Challenges and benefits of Research collaboration in a diverse region[46])

[46]Marmolejo F, Nagashima Y, Lothrop SC, Alborta SX, Aedo C, Miwa K, et al. South Asia: Challenges and Benefits of Research Collaboration in a Diverse Region. The World Bank, 2019

Figure 5.7 compares the per-unit gross domestic expenditure on R & D (GERD) in South Asian countries in comparison to the globe in terms of scholarly publications. Sri Lanka (6.8) and Pakistan (5.7) generate a considerably higher number of articles per unit GERD than the global (1.7) and SAARC averages (2.6). This is the latest graphical comparison available for the aforementioned sector.

5.8 Number of Scholar publications by population Size and number of Full Time Equivalent (FTE) Researchers - Comparison of Sri Lanka with Global and regional statistics
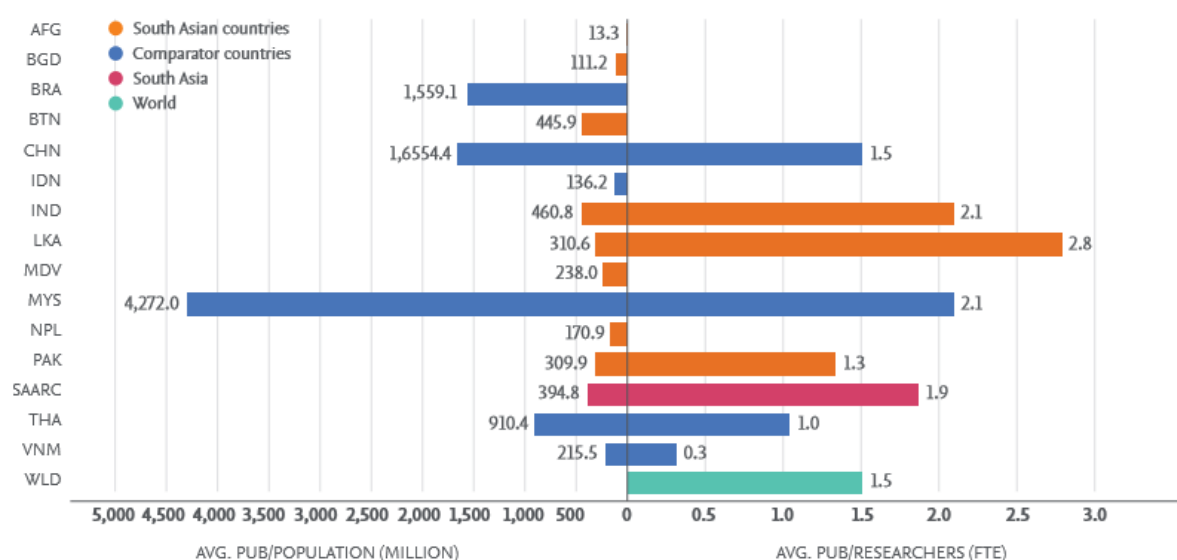
Figure 4

Number of scholarly publications by population size (lhs) and number of FTE researchers (rhs),
South Asian countries and global comparator countries, 2012-2016. Sources: UNESCO and Scopus®

Figure 5.8: Comparison of Sri Lanka with Global and Regional Statistics

(*Image Credit: South Asia; Challenges and benefits of Research collaboration in a Diverse region [47])*

Sri Lanka generates more scholarly papers per full-time equivalent (FTE) for the researchers than any other South Asian or comparative country, as seen in Figure 5.8. While China matches the global norm, Sri Lanka, India, the SAARC region, and Malaysia all outperform the global average in terms of academic papers per FTE researcher. This is the latest graphical comparison available for the aforementioned sector.

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[47]Marmolejo F, Nagashima Y, Lothrop SC, Alborta SX, Aedo C, Miwa K, et al. South Asia: Challenges and Benefits of Research Collaboration in a Diverse Region. The World Bank, 2019

5.9 Patents filed by S & T institutions

The number of patents filed per one million people is a good indicator that reflects the economic strength of a country[48]. As per the survey, a total of 11 patents, including 1 national and 10 foreign ones, were granted to the institutes, and five of them were implemented (Table 16). The institutes that acquired the patents with respect to the numbers are GJRTI (1 patent), ITI (1 patent, 1 implemented), NERDC (1 patent, pending), SLINTEC (2 patents, 1 implemented), ACCMIT (1 patent), TRI (1 patent, 1 implemented), NBRO (1 patent, 1 pending), PRI (2 patents, in process), and NRC (1 patent, 1 implemented).

Table 16: *The number of patents granted to scientists/institutions by sector.*

Sector	National		International		Total
	Implemented	Not Implemented	Implemented	Not Implemented	
Agricultural & Veterinary Sciences	0	0	0	3	3
Engineering & Technology	1	0	2	3	6
Medical & Health Sciences	0	0	0	0	0
Natural Sciences	0	0	1	0	1
Social Sciences	0	0	1	0	1
Total					11

5.9.1 IP Fillings in Sri Lanka

IP Filings (Resident + Abroad, Including Regional) and Economy

Year	Patent	Trademark (class count)	Industrial Design (design count)	GDP (Constant 2017 US$)
2011	214	5,156	686	200.47
2012		7,211	678	218.80
2013	445	6,899	295	226.23
2014				237.45
2015	265	7,440	405	249.34
2016	316	9,351	309	260.53
2017	331		485	269.85
2018	382	9,161	487	278.68
2019	412	7,990	606	284.97
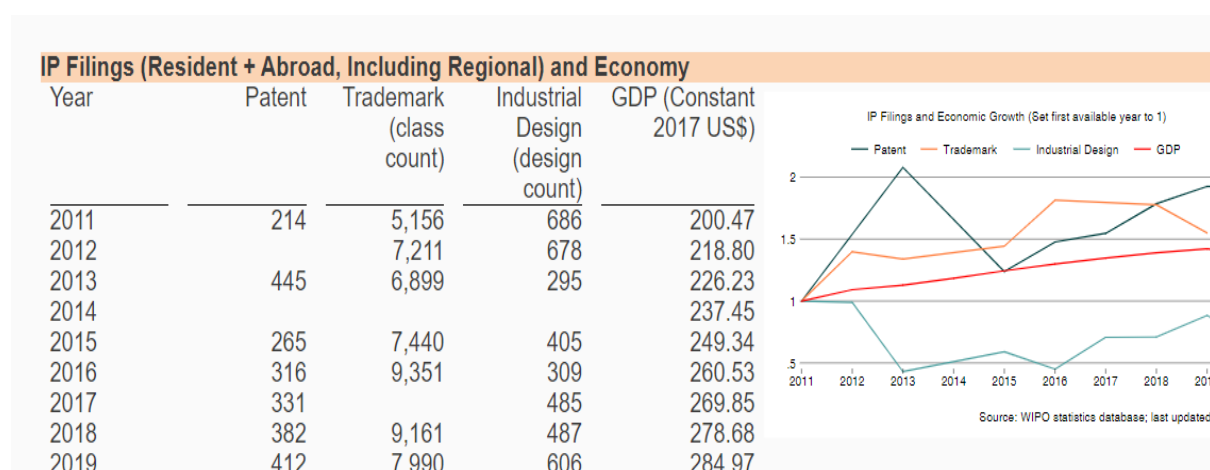
Figure 5.9: Source: Statistical Country Profile WIPO World[49]

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[48]https://www.patent-pilot.com/en/industry-studies/worldwide-industry-study-patent-law-firms-2016/patents-filed-per-one-million-inhabitants/

[49]https://www.wipo.int/ipstats/en/statistics/country_profile/profile.jsp?code=LK

5.9.2 The Patents filled and Granted between 2011 to 2019

Patent

Patent Applications

Year	Resident	Non-Resident	Abroad
2011	194	235	20
2012			33
2013	328	188	117
2014			17
2015	218	263	47
2016	280	293	36
2017	277	266	54
2018	343	260	39
2019	356	255	56
2020	353	251	59

Source: WIPO statistics database; last updated: 11/2021

Patent Grants

Year	Resident	Non-Resident	Abroad
2011	45	227	5
2012			6
2013	71	165	5
2014			6
2015	38	224	12
2016	41	82	13
2017	55	123	13
2018	64	148	11
2019	40	135	15
2020	52	221	17

Source: WIPO statistics database; last updated: 11/2021

Figure 5.10: Source: Statistical Country profile WIPO world

The WIPO statistics show that in 2019, 40 resident patents were granted against 356 applications filed (Figure 5.10) in Sri Lanka in total. Our survey only captured 11 (28%) of them that were granted to the S & T institutions.

5.10 Awards received by scientific staff / institution

The scientists of these institutions received 39 awards in total, which includes 29 national and 10 international honours (Table 17).

Table 17: Awards received by scientists/institution

Sector	International	National	Total
Agricultural & Veterinary Sciences	7	12	19
Engineering & Technology	1	9	10
Medical & Health Sciences	-	6	6
Natural Sciences	-	1	1
Social Sciences	2	1	3
Total	**10**	**29**	**39**

5.11 Products and processes commercialized by the institution

In 2019, seven processes and forty products were sought to attract possible primary consumer groups through various activities such as demonstrations, exhibits, mass media, and direct dialogues as part of the outreach of research outputs into the market. Tables 18 and 19 give the number of products and processes commercialized by the surveyed S&T institutes, respectively, and Figure 5.11 depicts their sectorial contribution.

Table 18: Products that have been commercialized by S&T institutions.

Sector	Institute	Number of Products Commercialized
Agricultural & Veterinary Sciences	PRI	2
	SCS	4
	SRI	1
	VRI	8
Engineering & Technology	ACCIMT	1
	CDRD	1
	ITI	4
	NBRO	1
	NERDC	5
	SLINTEC	3
Natural Sciences	DM	4
	SLAEB	6
Total		**40**

Table 19: Process that have been commercialized by S&T institutions.

Sector	Institute	Number of Process Commercialized
Engineering & Technology	CDRD	1
	ITI	3
	NBRO	1
	NERDC	2
Total		**7**
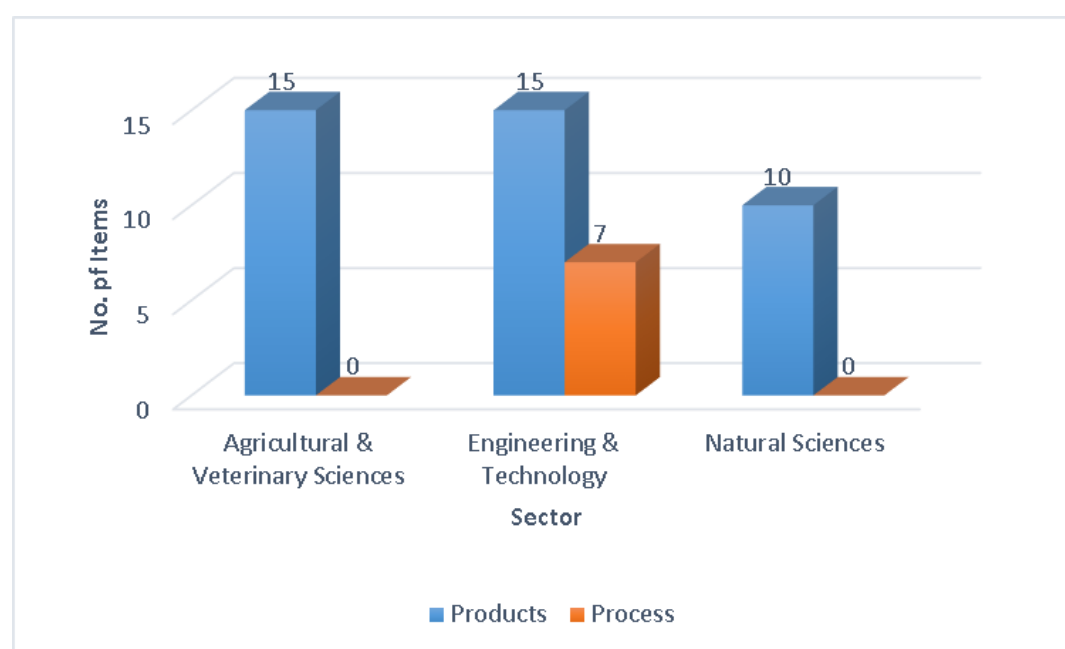
Figure 5.11: Commercialized products and processes in each sector

5.12 Technologies have been transferred, and recommendations have been implemented.

Technology transfer (TT) is the movement of scientific methods of production or distribution from one enterprise, institution, or country to another, such as through foreign investment, international trade, licensing of patent rights, technical assistance, or training. The process of commercially exploiting research varies widely. It can involve licensing agreements or setting up joint ventures or partnerships to share both the risks and rewards of bringing new technologies to market. Other corporate vehicles, e.g., spin-outs, are used when the host organization does not have the necessary resources or skills to develop a new technology[50].

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[50]https://www.globalnegotiator.com/international-trade/dictionary/technology-transfer/

Within the year 2019, 54 technologies were transferred (28 in the engineering and technology sector, 18 in the agricultural and veterinary sciences sector, 5 in the natural sciences sector, 2 in the medical and health sciences sector, and 1 in the social sciences sector), and 36 recommendations were adopted (15 in the engineering and technology sector, 14 in the agricultural and veterinary sciences sector, 4 in the natural sciences sector, 2 in the medical and health sciences sector, and 1 in the social sciences sector). Figure 5.12 indicates the number of technologies transferred and recommendations adopted in each sector.
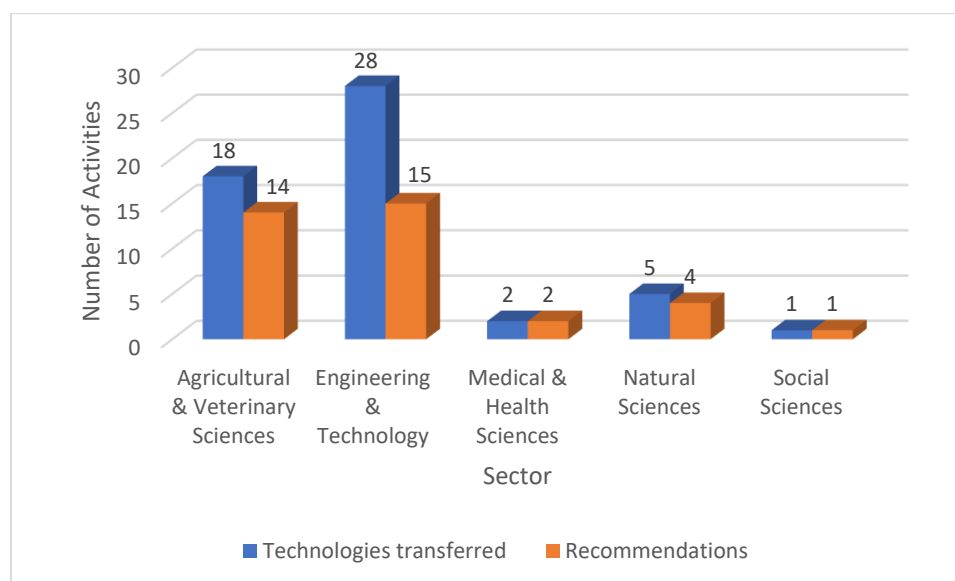
Figure 5.12: Technologies transferred and recommendations adopted in each sector

Several barriers have been faced by institutions during TT processes, such as poor linkage between R&D institutes and the industry, lack of trained staff for technology transfer, lack of funds and inputs, low priority given due to not being included in the institutional mandate, unwillingness of investors, technology acceptance by the industries, etc.

5.13 Sectorial comparison of S & T Output Indicators

Figure 5.13 depicts a sector-by-sector comparison of the three output indicators developed by the five sectors: agriculture and veterinary sciences, engineering and technology, natural sciences, social sciences, and medical and health sciences: product, process, and technologies per researcher.

Accordingly, the engineering and technology sector has the most products and processes (0.025, 0.011, respectively) per researcher (0.015), while the social science sector has the most technologies per researcher.
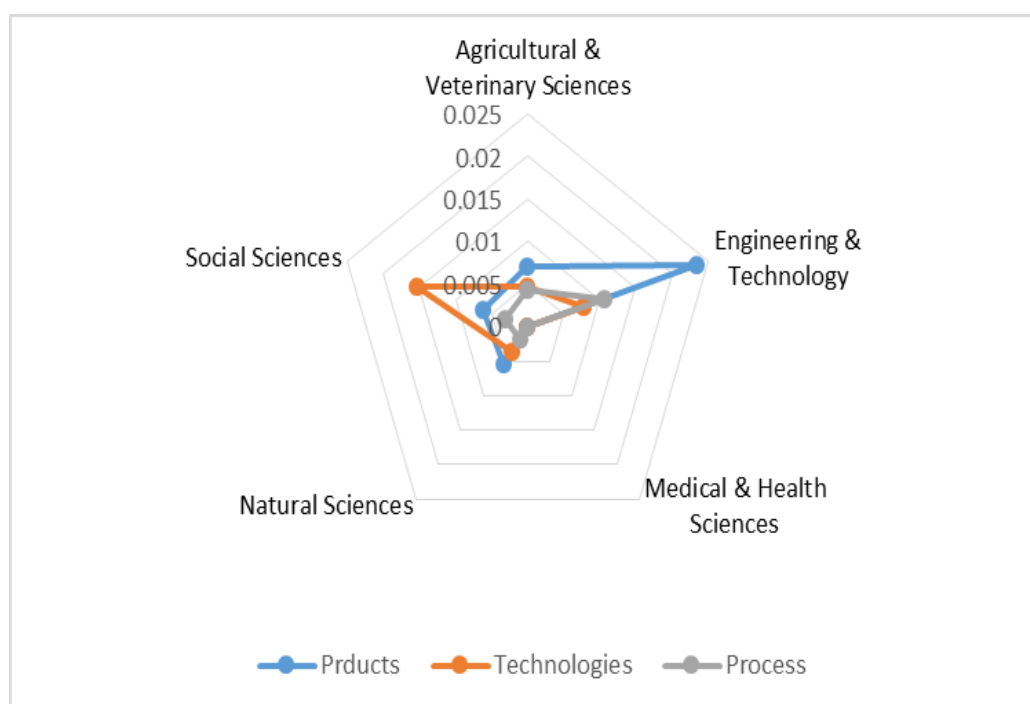
Figure 5.13: Radar chart comparing product, process, and technologies per scientist by sector in 2019

5.14 The impact of published scholarly Works on the Relative Activity Index (RAI) and Field-weighted Citation Impact (FWCI) of SAARC regional perspectives.
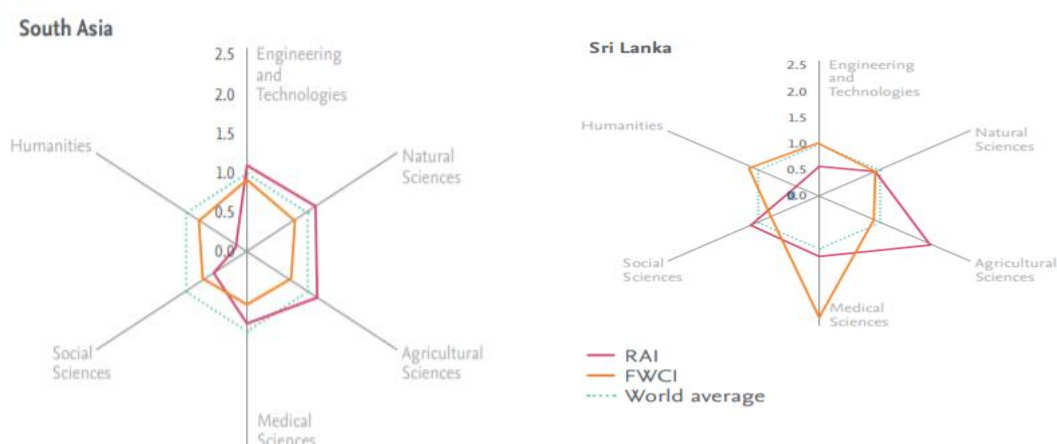
Figure 5.14: RAI and rebased FWCI for the world, South Asia, and Sri Lanka that published over 1,000 publications between 2012 and 2016. Source: Scopus®

The SAARC specifies agriculture, rural development, environmental management, natural disaster risk mitigation, and biotechnology as priorities for regional collaboration, which is reflected in South Asia's scholarly specialization[51]. At a national level, Sri Lanka mostly focuses on agriculture, followed by the medical sciences. South Asia's citation impact is closest to the global average in engineering and technology and is relatively lower in other sectors. In Sri Lanka, the citation impact is relatively higher in the sectors of agriculture and medical sciences than the global average.

5.15 Trends in Product-Processes-Technologies developed per institute, between 2012-2019

Figure 5.15 depicts the overall trajectory of new products, processes, and technologies developed at each institute from 2012 to 2019. The graph illustrates that the trend has been decreasing over time.
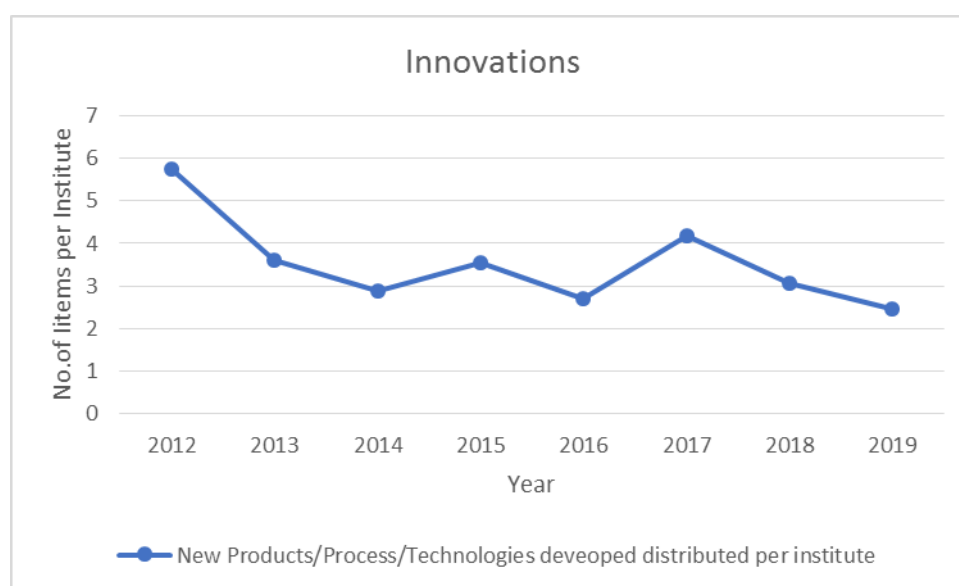
Figure 5.15: New Products-Processes-Technologies developed and distributed per institute Source: NASTEC S & T Data platform

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[51]Marmolejo F, Nagashima Y, Lothrop SC, Alborta SX, Aedo C, Miwa K, et al. South Asia: Challenges and Benefits of Research Collaboration in a Diverse Region. The World Bank, 2019

6. SERVICES PROVIDED BY S&T INSTITUTIONS

Most of the S&T institutes surveyed are mandated to provide different technical services to different target groups, such as industries, farmers, other S&T institutions, and the general public. The services provided by S&T institutions include testing, calibration of equipment, training, product and process certification, accreditation services, and consulting.

The number of clients served by S&T institutions for different services and the total revenue earned by each sector for these services are given in Table 20.

Table 20: Number of clients served with different services by S&T Institutions

Sector	Testing	Calibration	Calibration standards calibrated by DMUSS	Training	Product and Process Certification	Accreditation Services	Consultancies	Other Services	Total	Revenue Earned (Rs. Mn.)
Agricultural & Veterinary Sciences	6301	0	0	25930	3700	0	408	4181	**40520**	8.749
Engineering & Technology	9483	7362	0	1488	536	0	4714	1134	**24717**	754.772
Medical & Health Sciences	11	0			3	0	99031		**99045**	0.5
Natural Sciences	4736	1577	0	60480	0	0	40	647438	**714271**	471.7679
Social Sciences	219	3278	0	3069	708	0	0	0	**7274**	496.93
Total	**20750**	**12217**	**0**	**90967**	**4947**	**0**	**104193**	**652753**	**885827**	1732.7189

The sector of natural sciences served the highest number of clients (n = 714,271), while the engineering and technology sector generated the highest revenue (LKR 754.77 million against 24,717 clients). In total, the S&T institutes across the sectors served a total of 885,827 clients in the year 2019, and a total revenue of LKR 1732.72 million was generated through various client-based services. It was noted that some S&T institutes offered their services free of charge (n = 26). Table 21 shows the levels of revenue generated by different S&T institutes.

Table 21: Revenue generated by S&T Institutes in 2019

Revenue Generated			
Rs. Mn. 0-9	Rs. Mn. 10-20	Rs. Mn. 21-100	Rs. Mn. >100
DEA	ACCIMT	CEA	ITI
NIFS	GJRTI	SLAB	NBRO
FMRC	SLAEB	NERDC	DEMSS
MRI			SLSI
SLINTEC			
DM			

6.1 Revenue Generation Trends by Institute, 2012-2019

Since 2012, there has been an upward trend in revenue generated per institute through client-based services; as of 2019, each institute generated an average of LKR 31 million. However, this shows a SLR 9 million decline compared to 2018.
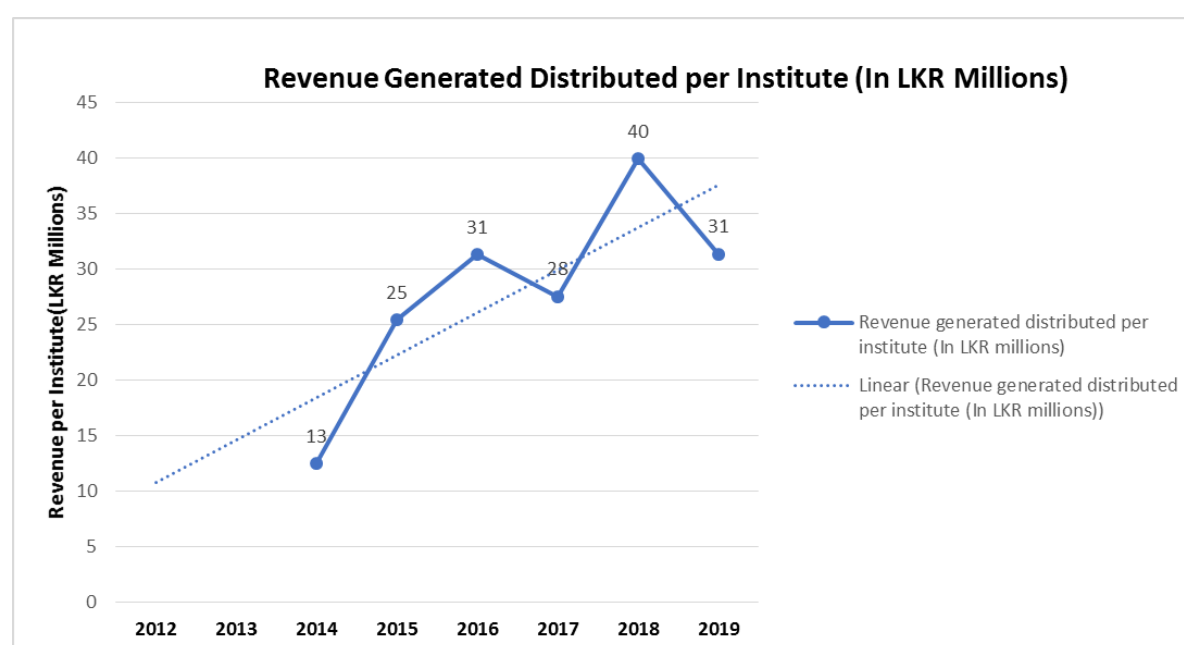
Figure 6.1: Distribution of revenue generated per institute, 2012-2019

RECOMMENDATIONS

Most of the recommendations presented in this report are ones that the system is already aware of, but they are purposely brought up again to underline their implementation. By putting them into practice, institutions would undoubtedly perform better overall, which may eventually help improve macroeconomic conditions and promote economic sustainability through innovative culture. In the medium run, a number of country index rankings in sectors like science, technology, innovation, and socioeconomics may also improve.

The recommendations are organized into five thrusts or sections: human resources, physical resources, research input, research output, and S&T institutions' services.

Thrust 01: Human Resources: Investment in Human Capital Development

I- Brain gain and retention of employees:
In order to retain the researchers, the system should identify the major reasons for employee turnover in the sector, and appropriate measures should be taken to address them immediately.

II- The implementation of such measures should be continuously monitored and routinely evaluated for desired outcomes.

III- Establish a performance-based reward system consisting of grants, incentives, and promotions to encourage highly performing researchers, not only young researchers but also experienced researchers'. Induct performance-based, competitive salary structures and benefits for researchers.

IV- Establish a postgraduate scholarship scheme in collaboration with local and foreign research institutes under foster employee development schemes.

V. Developing a national research and development funding policy and implementation strategies, which include the provision of adequate funding, incentives for researchers working at these institutions, and guidelines for optimizing fund utilization in R & D

VI. Filling the vacant cadre positions:

It was found that there was a substantial disparity between the existing cadre posts and the newly filled cadre posts. It was more than doubled at several institutions, particularly in the staff category of researchers. Hence, all existing cadre positions must be filled immediately, at least to a certain extent, to ensure the institutes' performance under the mandate.

VII. Fostering a gender equality workforce:

The results show that gender parity for researchers has been attained across institutions, but with a modest gender gap in the engineering and natural sciences fields. To encourage more female representation, they ought to encourage it within their system.

VIII. Mentorship and Career Development:

Promote engagement in the field of research through mentorship programs that pair experienced researchers with early-career scientists within and/or across the S&T institutes. The strategy could guide talented young researchers to nurture their fields of expertise.

IX. Promote public-private partnerships for research funding.

Encourage collaboration and joint ventures between academia, industry, and business entities. Such collaborations can bridge the gap between basic research and applications, ensuring sustainable scientific advancements to address societal needs.

X. Fostering an international research network for capacity building (a science diplomacy initiative):

Engage in bilateral and multilateral collaborations across borders.

  a) These collaborations provide opportunities for trainings, exchange programmes, and knowledge transfers, enabling the researchers to expose themselves to various research contexts and expertise.

  b) More focus should be placed on capacity building through international training.

Thrust 02 and 03: Physical Resources and Research Inputs: Optimize the Physical Resources for R&D Development

XI) Strengthen Funding:

Ensure a substantial portion of fund allocation for R&D activities at the institutes' level. A strategy may be adopted through diversified funding mechanisms such as grants, fellowships, and joint public-private R&D initiatives.

XII) Competitive funding mechanisms for research projects:

Funding for research projects should be prioritised according to national obligations. That might be in accordance with international goals for climate change, sustainable development, and government-designated sectoral focus areas. This area of focus may comprise:

a) Promoting research on sustainable infrastructure solutions, such as renewable energy technologies and eco-friendly construction materials (Zero Energy Building Concept).

b) Climate change Agriculture and Food Security

c) Promoting research on climate change mitigation and adaptation strategies and investing in research that would assess climate impacts, vulnerability, and the effectiveness of climate policies

d) Investing in R&D for innovative health care strategies that would enable affordable medication for all.

e) Investing in R&D for clean energy generation.

f) Disaster management strategies

XIII) Strengthen research infrastructure to enable high-quality research:

a) Provide state-of-the-art laboratories, equipment, and technology-sharing facilities.

b) Formulate a national policy on sharing research equipment for the provision of central equipment sharing facilities that would optimise the utilisation of high-end research equipment.

XIV) Develop a centralized monitoring system to track the project progress with SMART performance indicators linked to the key deliverables (i.e., a proposed system of the NASTEC-NPD Project Monitoring System— a pilot study). [52]).

XV) Develop a centralised database system that integrates research and service information across the institutes. This database should be accessible to authorised personnel and researchers, enabling them to search, retrieve, and contribute to the repository of knowledge. Ensure proper data categorization, indexing, and version control mechanisms.

XVI) Promote institutes to leverage information sources available for strategic planning, resource allocation, and informed, data-driven decision-making.

XVII) Promote open, transparent knowledge exchange through cooperative efforts between institutions, both local and international, to hasten the desired research outcomes (Open Science).

XVIII) To ensure on-time acquisition of essential chemicals, reagents, and laboratory equipment, streamline the state procurement procedure.

Thrust 04: Research Outputs- Research to business

XIX) Collaboration between industry and academia is encouraged through joint ventures, partnerships, and knowledge exchange initiatives. This partnership supports creative funding strategies to assure commercial-oriented research endeavors, particularly from industry and the private sector, in addition to facilitating knowledge and know-how technical exchange.

XX) Provide a legal framework to play the role of stakeholders at the interface of researchers and entrepreneurs. It would change the paradigm of researchers from job seekers to job creators.

Thrust 05: Services provided by the S&T Institutions: Ensure the delivery of quality services.

XXI) Strategically address the gap between the invention of a new product, process, or technology and its commercialization as a matter of priority. The strategies may include:

a) Establish Technology Transfer Facilities (TTF)—an office or subunit within the institutes to facilitate knowledge transfer, inventions, and research outcomes to reach the industry. The institutionalized units could be connected to the central clearing house at the national focal point.

b) Promote the concept of innovation hubs and technology parks where institutions, startups, and industry players can come together to collaborate, innovate, and commercialize product-process-technology advancements.

c) Invest in programs that facilitate the adoption and diffusion of research-based technologies. These programs provide financial incentives, training, and technical support to industries and organizations willing to implement innovative solutions. By reducing barriers to technology adoption, these programs accelerate the utilization of research products and processes in real-world settings.

XXII) Simplify the regulation of the development of products, processes, and technologies. Excessive red tape can stifle innovation and deter organizations from investing in cutting-edge technologies. Promoting a

more adaptable regulatory environment helps hasten the adoption and application of novel solutions.

XXIII) Update and modernize the services offered by S&T institutions to ensure that they are timely, effective, recipient-friendly, and accurate in accordance with their customers' expectations (tailor-made solutions).

Limitations:

The findings of the report have certain limitations, such as the standing of private-sector entities, and the information from the higher education sector in the country was not covered while conducting the survey. Thus, generalizing the findings to reflect the national status of S&T might be inappropriate. However, the institutions that were included in this survey are major players in their sectors and have a substantial impact on the national S&T ecosystem, and the findings were compared through global indices and Nations statistics wherever applicable

Conclusion:

In general, the institutions surveyed have made a collective contribution to the development of sectors within the scope of science and technology. However, the need for an appropriate framework to strengthen employee retention, research prioritization, resource optimization, R&D funding, data sharing, and research commercialization has not yet been fully addressed, particularly at the interface of science and legislature. There would be an urgent call to address them collectively through a comprehensive, mutually accepted framework.

Annexures

Annexure 01 – OECD classification by field of R&D (FORD) (OECD, 2015)

Natural sciences
- Mathematics
- Computer and information sciences
- Physical sciences
- Chemical sciences
- Earth and related environmental sciences
- Biological sciences
- Other natural sciences

Engineering and technology
- Civil engineering
- Electrical engineering, electronic engineering, information engineering
- Mechanical engineering
- Chemical engineering
- Materials engineering
- Medical engineering
- Environmental engineering
- Environmental biotechnology
- Industrial biotechnology
- Nano-technology
- Other engineering and technologies

Medical and health sciences
- Basic medicine
- Clinical medicine
- Health sciences
- Medical biotechnology
- Other medical science

Agricultural and veterinary sciences
- Agriculture, forestry, and fisheries
- Animal and dairy science
- Veterinary science
- Agricultural biotechnology
- Other agricultural sciences

Social sciences
- Psychology and cognitive sciences
- Economics and business
- Education
- Sociology
- Law
- Political science
- Social and economic geography
- Media and communications
- Other social sciences

Annexure 02 – Questionnaire format used for data collection

**National Review of the Status of Science and Technology in Sri Lanka –
Year 2019**

Questionnaire Survey

Objective of the Survey:
The National Science and Technology Commission (NASTEC) is mandated to submit an
annual report to the Government of Sri Lanka on the status of Science and Technology (S&T)
in the country. The information provided by your organization will be used only in the
preparation of this report.

The instructions and definitions attached to this questionnaire should be read carefully before
you fill the questionnaire and the format given in the questionnaire should be adhered to when
replying. Please ensure that **all the responses are limited to activities carried out during
year 2019.**

(I) GENERAL INFORMATION

1. Name of the Institution :

2. Postal Address:

3. Telephone:

4. E-Mail:

5. Web:

6. Fax:

7. Ministry/ Department:

8. Statutory functions: *(Please select relevant cage/s by a "x")*
   You may select more than one cage depending on the nature of your mandate

R & D		S&T policy formulation	
Research funding		Technology transfer	
S&T services		Science popularization	
Innovation		Training of personnel	

9. Please list any other major functions of your institution.

10. Does the Institution have a Corporate Plan/ Strategic Plan?

(II) HUMAN RESOURCES
(Please provide information on both permanent staff and staff on contract basis for more than 6 months in year 2019)

A) Staff Strength

i) Scientific, accounting & administrative staff (head count)

Staff	Total Approved Cadre Positions (Permanent staff)	Filled Cadre Positions (Permanent staff)	Staff on contract basis
Scientific			
1. Research Staff*			
2. Support Staff			
3. Librarians, Information Officers			
Accounting			
1. Accountants			
2. Support Staff			
Administration			
1. Executives			
2. Support Staff			
Other			
TOTAL			

* *Research staff should include research officers, scientific officers, engineers and research scientists. Total filled number of permanent cadre positions and staff on contract basis in Research staff in (i) should tally with the total values of (ii), (iii) and (iv).*

ii) a) Research staff* based on areas of expertise & gender (head count)

Area	Male	Female	Total
Natural Sciences			
Engineering & Technology			
Medical & Health Sciences			
Agricultural & Veterinary Sciences			
Social Sciences			
Other *(specify)*			
TOTAL			

ii) b) Public Research Profile of researchers

Research Profile	Number
Google Scholar Profile	
Research Gate Profile	
Others	

iii) Highest level of qualification of research staff* based on gender (head count)

Area	Male	Female	Total
Doctoral Degree			
MPhil Degree			
MSc/MA Degree			
Bachelor's Degree			
Diploma			
Full professional qualifications			
TOTAL			

iv) Research staff* by age group and gender (head count)

Age (years)	Male	Female	Total
> 51			
41 – 50			
31 – 40			
< 30			
TOTAL			

v) Staff remunerations

Institutions

Categories of scientific staff	Salary scale	Minimum qualification specified at recruitment
Research Fellow		
Senior Research Officer		
Research Officer		
Scientific Officer		
Information Officer		
Research Assistants (PhD students)		
other		

Universities

Categories of Academic staff	Salary scale	Minimum qualification specified at recruitment
Senior Professors		
Professors		
Senior Lecturers		
Lecturers		
Librarian		
Research Assistants (PhD students)		
other		

B) HR Development

i) Scientific staff trained at workshops, seminars and conferences (local and international)
(Head count) (*Please attach a separate sheet if necessary*)

Titles of training programmes	Duration *(In Days)*	Number Participated			Local / Foreign
		Research/ academic staff	Support / Technical staff	Librarian / Information officers	

ii) Postgraduate degrees/research training funded by institution for scientific staff within 2019 (head count)

Degree program	Research staff	Support / Technical staff	Librarian / Information officers	Duration
Doctoral Degree				
Mphil Degree				
MSc/MA Degree				
Postgraduate Diploma				
Training attachments				

iii) Scientific staff recruited by the institution within the year *(excluding transfers among regional centers of the same institution)*

Category	Highest qualification	Number
Research staff		
Academic Staff		
Support / Technical staff		
Librarian / Information officers		

iv) Scientific staff that left the institution within the year *(excluding transfers among regional centers of the same institution)*

Category	Reasons for leaving	Number
Research staff	Retirement	
	Obtained a new Job – local	
	Obtained a new Job – Foreign	
	Personal	
	Higher Studies	
	Other ………………………………………………	
Academic staff	Retirement	
	Obtained a new Job – local	
	Obtained a new Job – Foreign	
	Personal	
	Higher Studies	
	Other …………………………………………….	

Support / Technical staff	Retirement	
	Obtained a new Job – local	
	Obtained a new Job – Foreign	
	Personal	
	Higher Studies	
	Other ……………………………………………	
Librarian / Information officers	Retirement	
	Obtained a new Job – local	
	Obtained a new Job – Foreign	
	Personal	
	Higher Studies	
	Other ……………………………………………	

v) Benefits given to research staff

Perks	Research/Academic staff (Yes/No)	Support / Technical staff (Yes/No)	Librarian / Information officers (Yes/No)
Research allowance			
Medical insurance			
Transport facility / allowance			
Professional allowance			
Housing / Quarters			
Other (specify)			

(III) PHYSICAL RESOURCES

i) Infrastructure Facilities

Infrastructure facility	Number
Laboratory units	
Workshops	
Auditorium/Conference Hall	
Library	
Central instrumentation facility	
other	

ii) Other facilities

Facility	Availability (Yes/No)
Institutional website	
Database on research / services	
Internet with free access to Journals	
other	

iii) Major equipment available *(please attach a separate sheet if required)*

Name of Equipment	Percentage time utilized	Number		Year of purchase	Reason if not in working order
		Total	In working order		

iv) IT facilities

Facility	Number	
	Scientific staff	Administration staff
Computers, Central		
Computers, Personal and Laptop		
Printers		
Scanners		
other		

v) Specialized Software relevant to research

Specialized Software Package			
	Cost of purchase	Last renewal date	License Fee

(IV) RESEARCH PLANNING

I. **Whether reference made to the following documents in the preparation of Annual action plan of the institute**

National Research and Development Framework (NRDF)

YES		NO	

National Science and Technology Policy

YES		NO	

Other Documents
(Please List)

II. **NRDF based activities identified / implemented (10 focus areas & 10 interventions)**
   (Please select relevant cage/s by a "x")

Interventions → ↓ Focus Areas	Policy Formulation	Pure & Applied Research	Promotion of	Application of Nanotechnology	Application of Biotechnology	Application of Indigenous Knowledge	Testing, Standardization & Accreditation and Assurance of IPR	Capacity Building	Application of ICT	Popularization
Water										
Food, Nutrition & Agriculture										
Health										
Shelter										
Environment										
Energy										
Mineral Resources										

Textile and Apparel										
ICT & Knowledge Services										
Basic Sciences, Emerging Technologies & Indigenous Knowledge										

III. State future activities/projects identified by your institution to address UN Sustainable Development Goals (SDGs)

SGD Goal	Future activities/projects planned	Time frame		Expected outcome
		Year if initiation	Year of completion	
1. No Poverty				
2. Zero hunger				
3. Good health and well-being				
4. Quality education				
5. Gender equality				
6. Clean water and sanitation				
7. Affordable and clean energy				
8. Decent work and economic growth				
9. Industry, innovation and infrastructure				
10. Reduced inequalities				
11. Sustainable cities and communities				
12. Responsible consumption and production				
13. Climate action				
14. Life below water				

15. Life on land			
16. Peace, justice and strong institutions			
17. Partnerships for the goals			

(v) RESEARCH INPUTS

i) Funds received during the year 2019

Funds received for	Source of funding	Amount requested (Rs. Mn)	Amount received (Rs. Mn)	Amount spent (Rs. Mn)
Research projects	Treasury			
	NSF			
	NRC			
	Multilateral (e.g. UN Agencies, GEF etc.)			
	Foreign (e.g. JICA, MRC UK, USAID etc.)			
	Private sector			
	Other			
Science popularization, Workshops, Seminars	Treasury			
	NSF			
	NRC			
	Foreign			
	Other			
Upgrade of the institute *	Treasury			
	NSF			
	NRC			
	Foreign			
	Other			
Other (please specify)	Treasury			
	NSF			
	NRC			
	Foreign			
	Other			

Include purchase of laboratory equipment, construction of buildings, renovations, purchasing of land, vehicles, buildings etc. relevant to research

ii) If the funds received are not spent (there is a balance) what are the reasons? *(Please select relevant cage/s by a "x")*

Reason	Yes	No
Lack of human resources (researchers, technical staff, support staff)		
Lack of research equipment		
Delay in receiving funds		
Delay in receiving equipment, chemicals etc.		
Delay in procurement		
Inefficient planning and coordination		
Administrative issues		
Other *(please specify)* ………………………………………………………………… ………………………………………………………………… …………………………………………………………………		

(VI) RESEARCH OUTPUTS

i) Research Projects *(Please attach a separate sheet if required)*

Broad area of the research projects	Name of the research project	Collaborations if any *(International, other organizations, universities)*	Expected output/ outcome	Start date & End date	Duration	Ongoing / completed
e.g.: *1. Food science*						
2. Engineering						
3. Biotechnology						

ii) New products/ processes/ technologies developed through research during year 2019
(Please list and attach a separate sheet if required)
(Please refer section VI of Guidelines)

	Processes	Technologies	Products
Total			

iii) No. of publications

Publications	Number of publications
SCI Journals	
SCI extended journals	
Refereed Journals	
Total number of citations	
Abstracts of papers presented at conferences/symposia etc.	

Monographs	
Books	
Chapters in Books	
Others *(Please specify)* *(e.g. Bulletins, Newsletters, Magazines, Working papers)*	
Total	

iv) Patents received by scientists/ institution *(Please list)*

Item patented	Whether patented by individual/institute	Whether National/International	Whether implemented or sold

v) Awards received by scientific staff / institution

Award received	Whether received by individual/institute	For what *(eg: Research, Science Popularization)*	Whether National/International

vi) What are the products/ processes commercialized by the institution?
(Please list)

Processes	Products
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.

vii) How was the commercialization initiated?
(Please select relevant cage/s by a "x")

Commercialization Process	Yes	No
Demonstrated to private sector		
Through exhibitions		
Through *mass media		
Direct discussion with interested parties		

Other *(please specify)*		
………………………………………………………………………………………………… ………………………………………………………………………………………………… …………………………………………………………………………………………………		

*broadcasting (TV, radio, film), digital (internet & mobile) & printing (newspapers, magazines, pamphlets & books)

viii) If the institution was unable to commercialize the product/process what are the reasons/ barriers?

Reasons/ Barriers	Yes	No
No proper popularization mechanism		
Lack of trained staff		
Lack of funds		
Administrations issues		
Other *(please specify)*		

ix) What are the technologies transferred or recommendations developed *(Please list)*

Technologies transferred	Recommendations developed
e.g.: New method of water filtering	*e.g. New fertilizer mixture*
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.

x) What are the barriers faced in technology transfer?

Barriers	Yes	No
Poor linkage between R&D sections and the industry		
Lack of trained staff in technology transfer		
Lack of funds and inputs		
Low priority		
Unwillingness of Investors		
Not included in the existing institutional mandate		
Other *(please specify)*………………………………………		

(VII) SERVICES (FOR INDUSTRIES, S&T INSTITUTIONS, GENERAL PUBLIC)

Types & Area of services	Number of clients served	Revenue earned (Rs. Mn)
Testing facilities *Eg: Water* *Fertilizer*		
Calibration of equipment		
Whether calibration standards calibrated by Department of Measurement Units, Standards & Services		
Training *(list the training programmes conducted to outside sources and indicate the number participated)*		
Product/Processes Certification		
Accreditation of Services		
Consultancies		
Others		

VIII) CONSTRAINTS EXPERIENCED

Issue	Yes/No	Causes
Funding		
Recruitment/retention of staff		
Lack of cadre		
Procurement of equipment		
Overseas travel restrictions for scientific staff		
Training of scientific staff		
Other- please specify		

I hereby confirm that the above information given are true and correct to the best of my knowledge.

Name: _____

Designation: Signature of the Head of the Institution

Date:

Seal:

Annexure 03: Research Projects

S_No	Project	Expected output/ Outcome
Arthur C. Clarke Institute for Modern Technologies		
1	MIS Development	Efficient System for Decision Making
2	Mobile App Development	Few mobile Apps
3	Design, development, testing, launching and operation of cube satellite	First Sri Lanka engineer's developed cube satellite (Raavana-1)
4	Carbon fiber multicopter for surveillance and training	Demonstrable system for clients including defense sector
5	Fixed Wing UAV	Capacity development of engineers
6	Material Development to Reduce Grounding Resistance	A low cost material to reduce Grounding resistance, Paper publication
7	Cost Effective method to Improve Systems through PdM	Machine fault simulator, Software tool for analyses vibration data
8	Design and fabrication of a Smart Phone based ECG Trace Analyzer	To design a low cost device to analyze the ECG trace
9	Temperature Monitoring/Controlling System for Poly tunnel	Temperature Monitoring and Controlling System and a research paper
10	Centralized monitoring system for tests facilities	To develop a system to monitor the testing facilities
11	CSR Project, Electronic Kits	Delivering the kits to school
12	Xilinx Tea Colour Separator	Locally designed developed machine for tea factory tea processing
13	Deep diagnostic and Advanced Recovery of Locomotive Control Sub Systems	Increased number of locomotives in service of SLR
14	ADCS Testing system	Simulation model for Nano satellites

15	Real-time river water level information system (IoT product)	Information system to Irrigation Department
16	Cultivated Paddy Area Identification and Rice Yield Prediction Using Free Remote Sensing Data- For major paddy cultivation districts	Research Paper publications
17	Investigate the Potential of use of Synthetic Aperture Radar (SAR) data for Forest Height Estimation of Sri Lanka	Research Paper publications
18	Use of Geographic Information Systems for niche modeling of infectious diseases using remotely sensed environmental factors	Research Paper publications
19	Space Technologies for Assessment on Environmental Factors and Marine Cultured Pearl production Areas in Sri Lanka	Research Paper publications
20	Monitoring and identification tea Blister Blight using Spectral Signatures	Research Paper publications
21	Influence of Land Use and Land Cover Change on the Lightning	Research Paper publications
22	Mode Identification of Oscillations of Delta Scuti type stars using multicolor photometry and high resolution spectroscopy	Research Paper publications
23	Study and Investigate "Period Gap" of cataclysmic variable stars	Research Paper publications
Central Environmental Authority		
1	The impact of green practices on Financial Performance: A study on small and medium sized enterprises in Sri Lanka	• Aware the Entrepreneurs, whether the real commitment to green practices could influence the financial performance of their business. • The findings will motivate the newcomers to go with Eco-entrepreneurship
2	Assessment of impacts of Mini Hydro Power Projects, giving special reference to biodiversity, for selected mini hydro projects in Kalawana Divisional Secretariat Division	• Generate species check lists for Mudaligekanda and handuwelkanda forests in Kalawana Divisional Secretariat Division • Preparation of forest conservation plan for Kalawana Divisional Secretariat Division
3	Study of BOD and COD ratio in different industry sector with a view to utilize one measurement	• Identification and categorization of the industries into toxic, biodegradable and acceptable or stable zones using BOD/COD ratio • By zonation of the BOD/COD ratio, the treatment strategy could be identified to achieve the safe level of organic matter in an environment

4	Survey on Environmental awareness level of the community in Kegalle	• Promoting environmental communication among the community • Reduce the level of negative impact of human activities on the environment
5	Impact of direct discharge of uncontrolled wastewater from tourism industry to tributary of Kirindioya and aquatic life health quality assessment of the stream with respect to selected physico-chemical parameters and bio indicators (Odonate larvae)	Identification of significant relationship of the diversity and abundance of freshwater macro invertebrates (Odonate larvae) with selected environmental parameters
6	Study of water quality in vegetable wash water at selected locations of commercial vegetable washing by Checking COD, BOD and TSS	• Preparation of a chemical profile • Make aware the responsible agency to avoid the contamination of drinking water sources with pesticide residue and heavy metals
7	A comparative study on Environmental awareness, and attitudes among the secondary level school students in Rathnapura district	• Identification of gaps on environmental awareness and attitudes on environment of the secondary level students among all divisions
Centre for Defence Research and Development		
1	Development Smart Jacket with Tracking System (GPS/GPRS)	This system is aimed at identifying and tracking routs and the locations of soldiers in the battle field operations. The system will empower the traditional combatant with the smart technology.
2	Train Tracking and Operating Information System	The control center of Maradana can manage the trains efficiently. Furthermore, the passengers can view the location of train at real time.
3	Food Procurement Management System	To increase the efficiency of service, minimize the paper waste and workload of the end-users.
4	Land Acquisition and Management System	To increase the efficiency of service, minimize the paper waste and workload of the end-users.
5	MOU Management System	To increase the efficiency of service, minimize the paper waste and workload of the end-users.
6	Hi tech soldier III	This software helps to succeed the mission training of the military exercises by using the modern technology. The software consist as follows. a. Live tracking system. b. Incident report system. c. Conversion of the grids according to the maps.

		d. Monitoring facility of the battlefield soldiers from operational room. e. Analyzing the situational reports and special concentration.
7	Electronic Alarm System for Border Villages to Prevent Wild Elephant Intrusions - Phase II	Use electronic alarm systems to deter wild elephants. This system will help villages to protect from wild elephant attacks. Further system enhanced to capture truck, monitor and maintain information on Elephants in the Sri Lanka.
8	SLCORSNET Integration to CDRD Projects	To minimize the errors of the GIS mapping projects.
9	Drone Jammer	The equipment is highly mobile and can be used in any part of the country with minimum time. It disturbs the electromagnetic and GPS frequency ranges of Drones
10	Development of VHF/UHF Transceiver	1. To enhance the military radio communication capability by using amateur radio technology. 2. Project first phase will be aimed at VHF radio set which focus on VCO environment while the second phase aimed at software define radio sets by DDS environment. For transceiver, following steps are produced. a. Dual channel VHF Transceiver prototype. b. Programmable VHF Transceiver prototype
11	Development of Secure Voice Encryption Module	1. To enhance the security of existing analog radio sets with an easily pluggable module. 2. Planned to use 16 bit encryption keys which can be programmed through the keypad or using the software. 3. Integration of complete system with ongoing transceiver. 4. Integration of complete system for existing military radio setup.

12	Brain Control Robotic Limb	1. To get the real hand experience for amputees by brain controlled robotic arm. 2. Design a prototype that response to specific hand movements for a selected amputee. 3. To develop the prototype that can be implement to any amputee.
13	Smart Target for Jungle Lane Firing	1. To create a system which is capable of providing a real experience for lane firing without live ammunitions. 2. Comply the double tap requirement. 3. To have maximum range of 50m to 60m with the targets.
14	BTR80A Armored Tank Simulator	These units are highly expensive and require advanced technologies for maintenance and training. The main objective of this project is to acquire required technology for simulation. BTR Simulator has been completed. Currently the units are evaluating by the respective regiments in the Army.
15	T55 Armored Tank Simulator	These units are highly expensive and require advanced technologies for maintenance and training. The main objective of this project is to acquire required technology for simulation. 25% of T55 Simulator has been completed.
16	81mm Mortar Simulator	Provide basic training to 81mm Mortar Fire Controllers (MFC) and mortar controllers.
17	Vehicle Simulator	Provide Basic Driving training for driver's and reactions while driving.
18	Guided Rocket & Missile System	1. To establish rocket and missile technology within the Sri Lanka. 2. To commence production of Hi-Tech weaponry required for the purpose of the National Security. 3. To save and earn foreign exchange to the country.
19	Nano Paint Development Project	Ships requirement. Anti-corrosive paints and anti- befouling paints against the ocean water conditions around Sri Lanka. Paint has been developed based on sea conditions

		and the production can be done locally
20	Customizable Fire Control System Project	This involve designing the resurgent of a fire control system which can be used as per the respective service`s requirement. This is s common platform and the cost for production of independent units for different systems can be cut down.
21	Underwater Robotic Vessel - Phase I/ Phase II	This is a mini submarine which controlled remotely and can be used for under water explorations and underwater repairs.
22	Development of a Solar Paint	1. To cater for the renewable energy source requirement of the soldiers involve in LRRP operations. 2. Project involves the development of solar cell devices through the use of low temperature condition and characterization of solar cell devices. 3. Studying the long-term stability and feasibility of Perovskite device.
23	Development of virtual reality parachute jumper and sky driver training simulator	1. Planned to have to setup of concurrent visual systems for trainer and trainee 2. Planned to have environment feeling which occurs during the fall. 3. Interfacing HMD and Gyro sensor to the virtual reality environment. Also planning to develop system such a way that user can re configure followings: *Parachute types *Weather Conditions *Wind Speed *Geographic Location *Malfunctions.
24	Under Water Acoustic Sensor Array (UASA) - Phase I	The system will enable to detect activities in under the sea surface in support of naval Surveillance operations. As the accuracy of this eqpt is based on the conditions of the sea water, the local research and production is essential. The project also aims to create a data a

		data bank indicating different changes of sea water during the year
25	Hydrogen Fuel Cell	To develop high efficiency, low weight, high capacity, long lasting hydrogen fuel cell to be used with quad copter and UAVs to increase their flight time
26	UAV Lihiniya MK I - E	1. Lihiniya MK-I system is used to conduct the external pilot, internal pilot and observer training program Acquire indigenous knowledge on UAV and Autopilot Control System Development which is useful for national defence requirements.

Coconut Research Institute

1	Evaluation of hybrid vigour of brown dwarf crosses for yield and tolerance to moisture stress in different Agro ecological zones	2 cultivars Kapsuwaya and Kapsetha already released. Further evaluations on drought tolerance of cultivars in progress
2	Evaluation of hybrid vigor of Sri Lankan Tall and Sri Lankan Dwarf crossed with exotic varieties	Evaluations in progress to release new cultivars
3	Evaluation of intra-varietal dwarf coconut hybrids for home gardens and beverage purposes	SLYD released as a suitable variety to plant in home gardens, further evaluations in progress
4	Evaluation of King coconut germplasm to release a new cultivar for beverage industry	Preliminary analysis on genetic diversity of King Coconut populations, genetic relationships of King Coconut types and nut water quality of 4 populations from Kurunegala District completed
5	Collection and conservation of local and exotic germplasm and utilization in breeding programmes	Multiplication of local indigenous varieties Multiplication of conserved exotic germplasm Maintenance of field gene banks
6	Screening varieties/accessions/cultivars for red weevil tolerance	Only the preliminary screening was done,
7	Induction of somatic embryogenesis and plant regeneration in ovary derived callus	Improvement for protocol of plant regeneration from immature ovary tissue
8	Identification of new explants for vegetative propagation of coconut	Identification of potential of tender leaf as an explant for coconut micropropagation.

9	Dynamical evolution of hormonal signaling pathways in plant micro- propagation	Literature review on hormones/protein were completed and regulatory elements of hormonal signalling pathways involved in somatic embryogenesis were amended. Modelling is to be done to identify the important players.
10	Development of sustainable moisture conservation method by using carbonized plant material (bio-char) for mature coconut plantations	A significant increment in nut yield was observed after 4 years of biochar application and some important soil properties like soil organic carbon content, electrical conductivity and soil moisture effect on coconut production.
11	Development of a sustainable moisture conservation method by using carbonized plant material (bio-char) for coconut seedlings	Biochar applied in the field to the rate decided. Growth parameters of treated seedlings were measured 6 months after planting data are not significantly different. Soil analysis in progress.
12	Identification and evaluation of new mulching material on soil moisture conservation and the growth of coconut seedlings	Seedlings were mulched with different mulching materials. First set of data collected for evaluating the growth of seedlings showed no significant effect.
13	Quantification of below ground carbon stock and development of an allometric model to estimate the variation of below ground carbon stock of coconut palms in different age groups and in major land suitability classes	Excavation of root samples from the respective age categories and analysis of C content are in progress.
14	Determination of the Sulphur status of coconut plantations in coconut triangle	Hidden deficiencies of S in coconut plantations have been identified.
15	Evaluation of Co-compost Derived from Municipal Solid Waste and Dewatered Fecal Sludge to use as Organic Manure in Coconut Plantations	The macro nutrient contents in samples varied largely and most of the samples had low macro nutrient content. The organic carbon content of samples was rich and thereby most of the samples had unacceptable C/N ratio for soil application
16	Evaluating the effect of micronutrients on the growth and performance of coconut seedlings	No significant effect observed in nut yield, in the first set of data collected soon after application of micronutrients on palms .
17	Growth performance evaluation of high value resin crops under coconut	Data collection on growth parameters and nut yield recording is continuing.
18	Evaluating the adaptability of new intercrop species and varieties (Durian, Vanilla, Aloe Vera, and Tea)	Aloevera and durian were established in the field and data collection is in progress.
19	Evaluation of new herbicides (Continuous long term research work)	One herbicide trial was completed in the field and recommendations were provided.
20	Investigating the Alternative Uses of Panicum maximum (Guinea Grass)	Experiment on compost production using guinea grass was completed and nutrient analysis is in progress.

21	Assessment of prevalence of black beetle and red weevil in climatic zones	Gathering information on pest dynamics
22	Development of coconut cultivars resistance to coconut mite using morphological parameters	Data collection on yield parameters and mite incidence continued at 3 experimental sites
23	Evaluation of Sri Lanka Tall and Sri Lanka Dwarf crossed with exotic varieties for resistance/ susceptibility to the damage by coconut mite	Data collection is in progress at 3 sites Middeniya, Siringapatha and Wanathawilluwa
24	Screening of coconut varieties/ hybrids tolerant to Weligama Coconut Leaf Wilt Disease	Data collection on disease incidence continued at two experimental sites
25	Development of new cultivars tolerant/ resistant to Weligama Coconut Leaf Wilt Disease	Data collection on disease symptom appearance continued at six experimental sites
26	Conducting surveys to assess the impact of release of predator mites to control *Aceria* mite	Completed the treatment application and data collection was continued.
27	Conversion of non- systemic insecticide into a systemic insecticide by nanotechnology	Non-systemic insecticides with systemic properties
28	Field evaluation of different semio- chemical formulations to trap coconut black headed caterpillar	Recommendation on a semio-chemcial for black headed caterpillar
29	Study behavioral responses of Plesispa to leaf volatiles	Information on responses of Plesispa to leaf volatiles
30	Identification and use of pheromone synergist/ kairomones for red palm weevil	pheromone synergist/ kairomones for red palm weevil
31	Development of pheromone dispenser for red palm weevil	A new effective pheromone dispenser for red palm weevil
32	Determination of suitable formulation and dispenser for black beetle	A formulation and dispenser for black beetle
33	Laboratory screening of potential essential oils (EOs) against black beetle, red palm weevil and plesispa beetle)	Information on essential oils (EOs) against black beetle, red palm weevil and plesispa beetle
34	Study the searching behavior of coconut mites and *N. baraki* on different varieties	Information on searching behavior of coconut mites and *N. baraki* on different varieties
35 36	Determination of volatile. organic compounds of different coconut varieties.	Information on volatile. organic compounds of different coconut varieties
37	Determination of lipid profile of epidermis of fruits of different coconut varieties.	Information on lipid profile of epidermis of fruits of different coconut varieties.
38	Determination of phenolic compounds of epidermis of fruits of different coconut varieties.	Information on phenolic compounds of epidermis of fruits of different coconut varieties
39	Development of an integrated method using predatory mites and palm oil and sulphur mixture to manage coconut mite	Recommendation on an integrated method using predatory mites and palm oil and sulphur mixture to manage coconut mite
40	Development of a mass rearing technique for N. paspalivorus	mass rearing technique for *N. paspalivorus*

41	Improvement of Extra VCO production	Two process developments in laboratory conditions
42	Development of coconut butter	Method for making coconut butter developed
43	Production biodegradable packaging from coconut protein isolates and biocelluloses	Different typed of package material developed at laboratory level
44	Development of a protocol for Nata de coco production	Protocol developed
45	Nutritional studies of coconut sap-based sugar	Glycemic index of coconut jaggery with healthy people 32.41 and that for table sugar was 34.99.
46	Improvement to the quality of coconut sap and its products	Use of hal bark for arresting fermentation make coconut sap unsuitable for human consumption without further processing due to microorganisms
47	Development of a technology for coconut coir retting using consortium of microorganisms	NO significant effect was observed with the consortium isolated
48	Investigation of physical and chemical changes during deep frying of coconut oil	one publication
49	Determination of the effect of virgin coconut oil in the treatment of Alzheimer's Dementia	03 oral presentations, Ph.D. thesis and two publications on progress
50	Anti-diabetic and anti-oxidative potentials of partially-defatted coconut parings of indigenous coconut cultivars	3 publications
51	Identification of the contributing factors for coconut prices and developing the price forecasting model	Basic model has been developed. Further improvements to the model are in progress. Review paper has been published
52	Assessing the impact of external shocks to the coconut market, tariffs on edible oil imports by an Equilibrium Displacement Model approach	Model development is in progress
53	Assessment of international organic fertilizer standards and related crop export regulations on the use of local organic fertilizer sources to organic coconut industry in Sri Lanka	Data collection from target areas completed.
54	Dynamics of household coconut and edible oil consumption of Sri Lankan consumers	Household data collection of Kurunegala and Puttalam completed. Data collection of Gampaha is in progress.
55	Consumers' wiliness to pay for food safety labelling: The coconut oil market in Sri Lanka	Initial data collection completed. Field survey planned.
56	Productivity improvement under climate uncertainty in home gardens in most vulnerable areas	Data collection in Hambantota and Matale districts are completed
57	Review of coconut sector policies and sector performances: An index number approach	Initial model has been developed
58	Supply response analysis of coconut production	Model development completed.

59	Value chain analysis of sap-based products of coconut industry in Sri Lanka	Initial data collected from the Provincial Office was completed.
60	Market dynamics and industry setting of coir fiber sector	Data collection in Gampaha completed. Data collection from coir millers in Puttalam is completed but data collection through the value chain is to be done.
61	Assessing the occurrence of the Tapering Disorder among CRIC 60 (TxT) palms	Research completed. Final report to be issued
62	An analysis of the impact of diverse nature of the economic transitions on Sri Lankan coconut sector	Research completed. Final report to be issued
63	Evaluation of the success of coconut replanting programs of Sri Lanka	Surveys for evaluating the seedlings in Gampaha CCB region were completed.
64	Optimizing experimental designs in coconut research	Improved statistical techniques for data analysis have been identified & optimum plot size was estimated.
Department of Export Agriculture		
1	Investigation of the feasibility of expanding Vanilla cultivation in Central Province, Sri Lanka	Identifying the feasibility of expanding Vanilla as a cultivation in Central province
2	Design a trap for Coffee Berry Borer	Ethanol : Methanol 1:1 solution is the best to catch the coffee berry borer female insects
3	Investigations of biological control agents of coffee berry borer	One of hymenopteran insect was identified as a Eulophid parasitoid) Phymastichuscoffea LaSalle.
4	In-vitro propagation of Garcinia and wallapatta	Mass plant production using tissue culture technology and new variety development
5	Pepper canopy improvement through different planting material originated from different cutting types and canopy training.	Identification of suitable cutting types to pepper canopy improvement
6	A comparative Study of growth, yield and quality of Half-Sib progenies of Sri Gemunu& Sri Vijaya Cinnamon varieties	Identification of efficient method to replace existing seedling cultivations with improved genetic material
7	Growth and yield performance of Macadamia VP plants at different spacing levels	Introduction of Macademia VP cultivation to Sri Lanka
8	Determination of pollination behavior of wild cinnamon based on flower morphology, floral behavior and molecular markers: A case study on mother plants of Cinnamomumdubium (Nees), Cinnamom	Determination of factors affecting pollination behavior of Genus Cinnamomumumlitseaefolium (Thwaites) and Cinnamomumcapparucoronde (Blume), and their progenies at mid country research station, Dalpitiya, Sri Lanka
9	Comparative Study of the effectiveness of using alternative potting media for propagation of black pepper	Identification of alternative potting media for black pepper

10	In-vitro propagation of wallapatta	Mass plant production using tissue culture techniques
11	In-vitro propagation of Alovera	Mass plant production using tissue culture techniques
12	Investigation of etiology, disease development and management of rough bark disease of cinnamon	Identification of causal agent, investigation on disease development and integrate management of RBD of cinnamon
13	Studying the ecology of cinnamon wood borer (Ichneumenopteracinnamomumi	To find out the seasonal abundance of cinnamon wood borer
14	Identification and studying the biology, ecology and management of cinnamon thrips	To identify the thrips taxonomically & to identify the biology and the ecology
15	Study the white root disease infection, its pathogenicity and ecological factors that enhance the disease in cinnamon	To confirmation of the pathogen To find out the disease development pattern in host
16	Study the disease progressive pattern and yield loss by canker incidences in cinnamon	To study the symptom development of canker in cinnamon stem with different maturity levels.
17	Establishment and evaluation of electric fence and ultra-sonic audio devices to manage vertebrates pests in cinnamon	To find out the avoidable vertebrate pests from the electric fence. To find out the recoverable yield loss from the pests due to fence.
18	Taxonomy of Cinnamon Thrips	Identification of Cinnamon thrips
19	Cinnamon quality with Agro ecological variations	
20	Cinnamon shelf life with different packaging materials	
21	Quality of cinnamon quills at three levels in value chain	
22	Anti-fungal and anti-bacterial activity of true cinnamon	
23	Effect of Cinnamon Leaf compost and inorganic fertilizer and their combinations on growth and yield of Cinnamon	evaluate the effect of compost on growth, yield and disease resistance of cinnamon
24	Effect of dolomite application on growth and yield of cinnamon grown in acid soil cinnamon grown in acid soil	To find out the effect of dolomite on growth and yield of cinnamon
25	Effect of applied sulfur containing fertilizers on growth and yield of	To find out the effect of Sulphur addition on growth and yield of cinnamon
26	Determination of Optimum pH level for growth of Cinnamon	Find the best dolomite dose for optimize the soil pH that maximize the growth of Cinnamon

27	Identification of visible indicators of cinnamon (CinnamomumzeylanicumBlume) to monitor major and minor soil nutrients	Identify the cinnamon deficiency symptoms
28	Effect of biofilm-bio fertilizer on growth and yield of cinnamon	Identify the effective dose of biofilm bio- fertilizer
29	Effect of market available Cinnamon fertilizer mixtures on growth and yield of Cinnamon (CinnamomumzeylanicumBlume)	evaluate the effect of available fertilizer with compared to current Cinnamon fertilizer recommendation on
30	Effect of type of planting materials and different rate of inorganic and organic fertilizer on growth and yield of cinnamon	To compare growth and yield performances between vegetatively propagated plants (Sri Gamunu& Sri Wijaya) and cinnamon seedling plants.
31	Effect of different levels N, P and K fertilizers on growth, yield and quality of the cinnomon	To find out a suitable level of N, P and K nutrients
32	Evaluation and comparison of superior quality characteristics of accession A1 (Pieris cinnamon) with selected cinnamon accessions (Sri Gemunu and Sri Wijaya)	To identify and evaluate the superior quality characteristics of accession A1
33	Multiplication and evaluation of selected hybrid cinnamon plants under recommended agronomic practices for quality, growth, and yield performance	To identify superior quality cinnamon accessions
34	Identification of chemical and element composition of sandy textured cinnamon bark	To identify the effect of sandy textured cinnamon on chemical composition.
35	Evaluation of seasonal variation in rooting ability of shoot cuttings of cinnamon varieties "Sri Gemunu" and "Sri Wijaya"	To estimate the trend for cutting germination and sprouting of released cinnamon varieties according to the months of year Coco-peat pellets as a nursery media for cinnamon
Farm Mechanization Research Centre		
1	Groundnut harvester	To modify imported harvester to suit to the local condition
2	4W Tractor coupled vacuum seeder	To introduce precise seeding method and seeder for small seeds such as seasami, finger millet
3	Tiller for boggy land	To introduce tiller machine to land preparation for boggy land
4	Cowpea thresher	To introduced two wheel tractor driven thresher for cowpea
5	8'' paddy transplanter	To introduce trans-planter with 8" planting space
6	Pulse processing machine	To introduce new pulse processing machine to remove husk and split pulse grain

	Field Crops Research and Development Institute	
1	Seed multiplication and cropping technology development for onion varieties in Sri Lanka	Onion Seed multiplication and cropping technology
2	Development of technology to increase soybean productivity in Sri Lanka	Increased Soybean Productivity
3	Follow-up management of high quality onion seed production demonstration village	Increased quality of Onion
4	Establishing farm-based chilli hybrid seed production system in Sri Lanka	Increased Hybrid seeds availability
	Forest Department	
1	Domestication & tree improvement	
2	Tissue culture	
	Fruit Research and Development Institute	
1	Characterization of flowering behavior and floral biology of Anona, Sapota, Weralu and Jambu	
2	Genetic improvement and varietal development of mandarin through hybridization	
3	Development of high yielding and good quality varietal hybrids of pineapple	
4	Identification of bioactive compounds of selected fruit crops	
5	Studies on Biology and Management of root knot nematode (*Meloidogynespp*)	
6	Management of guava wilt through biological control agents	
7	Regulation of Fruit set and postharvest life and investigation of variability of bioactive compounds in edible *Annonamuricata* accessions found in Sri Lanka.	
8	Development of hybrids and open pollinated varieties and seed production (Fruit crops)	
9	Climate Resilient green technological improvement for food crop production and smart dissemination of technology to ensure food security in Sri Lanka	
10	Increasing Farmers income of Sri Lanka by improving quality and productivity of Mandarin (Kopia)	
11	Initiative for Commercial Breadfruit Production in Sri Lanka	
12	Development & expansion of fruit sector in Sri Lanka	

Gem and Jewellery Research and Training Institute		
1	Exploration and assessment of Gem deposits in Sri Lanka	Three Maps and Final reports
2	Study on a low harm gem deposit identification method using ground penetration radar data and ground resistivity measurements for sustainable exploitation.	Project Report
3	Study on other economically valuable minerals available in gem bearing layer.	Project Report
4	Investigation of novel methods of Heat treatment of low-quality Gem stones with coloured metal oxides for value addition.	Project Report
5	Value Addition of Gemstones by Heat Treatment	Project Report
6	Fabrication of wound-healing bandage/plaster of mineral nano particulate to which antibiotics have been embedded for slow releasing kinetics for chronic wounds where proteolytic enzymes are in action.	Project Report
7	Investigation of powdered minerals for Cosmetic creams, soothing ointments production for possible topical application.	Project Report
8	Development of strong and pressure endurable eco-friendly interlocked bricks using non-degradable plastics, cement and minerals (tailing of mining) produced by gem mining.	Project Report
9	Build a National Repository of Sri Lankan Gem Mineral Data*	Project Report
10	Propaganda & Awareness	4 Awareness Programs 02 Books
11	Sri Lanka NEXT	
Hector Kobbekaduwa Agrarian Research & Training Institute		
1	Determinants of Paddy Production of Sri Lanka: The Impact of Policy, Input Use and Climate	Utilization of information generated through this research in policy formulation

2	Fruit and Vegetable Consumption Patterns in Sri Lanka	Strategies to motivate households to adopt recommended level of fruit and vegetable consumption
3	Value Chain Analysis of Milk Industry in Sri Lanka	Increase the income of dairy farmers by directing them to practice the best value chain
4	Consistency between Purpose of Alienation and Current Practices of Alienated Lands under Land Development Ordinance	Improved productivity of alienated lands under land development ordinance through optimal occupation and development of those lands
5	Success of Targeted Extension for Pest and Disease Control in Food Crops : An Action Research on Mobile Based Solutions	Consumption of high quality and toxic free foods by consumers and increased net income for farmers
6	Programme Management: Challenges in Implementing Development Programmes/Projects by the Department of Agriculture and Department of Agrarian Development	Effective and efficient programmes and projects by the Department of Agriculture and Department of Agrarian Development
7	Determinants of Farmer's Decision on Vegetable Production in Sri Lanka	Knowledge of determinants which is leading to farmers decision making and measures to reduce imperfect information with regard to vegetable sector in Sri Lanka
8	An Analysis of Rice Value chain in Major Milling Zone	Increase the efficiency of paddy/rice VC in Sri Lanka
9	Study on Water Management and Governance Issues in Eastern Slopes of Central Highland Region	System of sustainable water allocation system acceptable for different parties
10	Effects of present traditional land tenure system (Thattu – maru and Katti – maru) on agricultural productivity in the wet zone of Sri Lanka	Improved land productivity in wet zone of Sri Lanka
11	Impacts of Awarding Minor Irrigation Rehabilitation Contracts to Farmer Organization	sustainable and effective MIR through FO's by revising the procedure of awarding contracts to FO's without following competitive bidding procedure
12	Study on the Potential of Home gardens to Increase the Coconut Production in Sri Lanka	Increase the coconut cultivation in home garden level and increase the total coconut nut contribution to the National production
13	Development of an App to Create Market Link Among Producers, Sellers and Customers	Facilitate to deliver reasonable vegetable price for all parties with creating digital platforms to link between farmer, seller and customer

14	Nationally important agricultural heritage systems of Sri Lanka: Recognition, applicability and conservation	To provide policy recommendations on identification, application and conservation of nationally important agricultural heritage systems of Sri Lanka

	Industrial Technology Institute	
1	Biodiversity and technological potential of micro-flora from selected Sri Lankan dairies	Isolation of probiotic bacteria from bovine milk with potential industrial applications
2	Studies in surface sterilization of spices using non-thermal processes	Cold plasma/UV treatment for elimination of microorganisms
3	Enhancing the nutritional stages of people by introducing healthy food products from jack, pumpkin, banana and fish while reducing postharvest losses of these commodities.	innovative value-added products developed will contribute to full fill the nutritional gaps of the local community while increase the foreign exchange by strategic marketing
4	Screening of Anti-Nutritional factors (ANFs) and activity of bio active proteins in locally grown edible legume varieties.	• Development food products from Horse gram • Method development for Trypsin inhibitory assay • Booklet on Nutrition properties of legumes and pulses
5	Screening and assessment of Lactic Acid Bacteria from Sri Lankan dairies as source of functional ingredients for the industry	Development of functional ingredients for the Industry
6	Study on the use of sugar substitutes for food products, their detection and the development of low-calorie foods	Development of low-calorie food
7	Curing of bamboo culm that suit to tropical environment and bamboo products development	Development of low-calorie food bamboo
8	Development of a data base on nutritional, chemical, molecular and morphological characteristics of selected traditional and widely consuming improved rice varieties of Sri Lanka: suitability to use as chemical and molecular finger prints in identifying rice varieties at grain level	Database on widely consuming rice varieties in Sri Lanka
9	Development and scaling up of technologies of value-added products from selected underutilized fruits and investigation of their functional properties	Preparation of healthy foods with bio active components including juices/drinks from underutilized fruits not available in the current local market
10	Spray drying of selected fruits, vegetable juices and yam pulps and innovative spray dried powder-based product development	Development of carrier agent parameters to control stickiness, anti-caking and drying agents to produce free flowing fruit / vegetable juice powders

11	Development of technologies to utilized waste whey in local dairy bio processing industries for the production of value added / functional beverages	Development of value-added whey based functional beverages to Sri Lankan consumers
12	Establishment of a facility for thermal process validation of canned food and low moisture processed food operations in Sri Lanka	Establishment of a facility for thermal process validation of canned food and low moisture processed food
13	Development of plant-based fungicide formulation to control anthracnose disease of mango and papaya	Development of a bio fungicide for the control of postharvest pathogens
14	Rapid extraction of medicinal & aromatic plants and flowers & selective isolation of compounds by microwaves	Use of Microwave Hydro-diffusion and Gravity microwave technology to prepare extracts and essentialoils.
15	Comprehensive utilization of Sri Lankan *Moringaoleifera*in developing health fo herbal medicinal products to start up *Mo oleifera*industry in Sri Lanka	Startup Moringaoleifera industry in Sri Lanka Development of Herbal tea, Chewable Moringa capsule, burn cream and Anti-inflammatory ointment
16	*In silico*studies of drug leads from Sri Lankan natural products	Identification of drug leads for some selected plants
17	Development of new value-added heath products incorporating underutilized bio medicinal plants to address life style dise Sri Lanka	Development of new value-added heath products incorporating underutilized bioactive medicinal plants
18	Evaluation of impacts of agrochemicals o wine cultivating soil and water and study heavy metals, nitrates and phosphates	To make the farmers aware about proper use of agrochemicals and study the soil and water for contamination
19	Investigation on natural fragrances and other volatiles from Sri Lankan flora and their industrial applications	Identification and isolation of new natural fragrances from Sri Lankan flora for industrial applications
20	Development of nutritional instant porridge as a supplementary food for the patients with diabetic mellitus and cholesterol	Antioxidant rich instant herbal porridge from leafy vegetable
21	Value addition to essential oils by fractional distillation under vacuum	Value added essential oils
22	Pharmacognostical, chemical characterization and selected bioactive properties of Canariumzeylanicum and development of value-added products.	Development of marketable products such as joss powder, mosquito repellents, flies repellent, perfumes, anti-inflammatory products
23	Selected chemical, nutritional and functional health benefits of Sri Wijeya and Sri Gemunu high yielding Cinnamon varieties	Physio-chemical and bio active properties of new cinnamon verities
24	Fabrication of low-cost graphite-based composite electrode for electrochemical applications (at high- temperature) as a value addition to local minerals	Fabrication of low-cost stable graphite based composite electrode with enhanced electrical and mechanical properties

25	Development of red clay-based water filter /apparatus for removal of hardness in drinking water	Red clay-based water filter to remove hardness in drinking water
26	Reduction of vehicle exhaust emissions by nanoparticle supported adsorption material	Development and optimization of nanocomposite material for gas adsorption
27	Conversion of Sri Lankan natural quartz to solar grade silicon for applications in electronic industries	Development and upgrading low- cost electrochemical method for silicon production from quartz
28	Cost-effective removal of synthetic organics (SOCs) and heavy metals from pesticides in aqueous phase using TiO_2	Development of a method to remove SOCs and heavy metals from pesticides
29	Improvement of thermal conductivity of rubber using graphite-based nanocomposite as a value addition	Development of graphite based nano-composite to improve the thermal conductivity of rubber
30	Development of low cost, ecofriendly domestic system to compost bio degradable food waste	Development of a domestic system to compost food waste in 24 hours
31	Development of Lubricant products from local graphite Production of polylactic acid (PLA) based low cost bio degradable plastic film as a replacement for polythene shopping bag and "Lunch sheet"	Local business startup with local graphite Development of a process to produce comparatively low-cost biodegradable plastic film to be used in lunch sheet and shopping bags
32	Design of production process equipment and wastewater treatment plant for Graphene production process	wastewater treatment system for the purification of wastewater discharge from Graphene production process
33	Development of a MI temperature tunnel control system	temperature tunnel control system
34	Development of a wireless humidity and temperature data acquisition and monitoring system	Humidity and temperature data acquisition device
35	Amino acid profiling of selected Sri Lankan rice varieties using liquid chromatographic techniques	Amino acid profiles of selected Sri Lankan rice varieties
36	Investigation of calcium, magnesium and heavy metals uptake efficiency of *Terminaliaarjuna*(Kumbuk Tree) as a phyto-remediation species for water quality improvement of CKDu affected areas	To use roots of T. arjuna as a phyto-remediation species for water quality improvement of CKDu affected areas
Irrigation Department		
1	Soil & Land use survey in Kantale irrigation project	Soil map of Kantale Irrigation Scheme
2	AlikotaAra Reservoir Project/ Wewelanda Project	Hydraulics solutions & erosion protection

3	AlikotaAra Reservoir Project / Wewelanda Project	Hydraulics solutions & erosion protection
4	KanthaleJanaranjanaWewa	Hydraulics solutions
5	Restoration of ancient village tank systems in SL	Methodology for sustainable restoration
6	Water management in Mau Ara System	Established measuring network
7	Major tanks in Anuradhapura, Polonnaruwa&Hambantota area	Database and report
Medical Research Institute		
1	Whole-Genome Sequencing Analysis of Nxntyphoidal Salmonella ernterica of chicken meat and human origins under surveillance in Sri lnka	
2	Preliminary investigations on molecular patterns of salmonella enteritides using pulse field gel electrophoresis (PFGE)	
3	Development of food composition tables	Sri Lanka Food Composition data base, To improve the smallholder livelihood nutrition in Sri Lanka
4	Nutrition status, food consumption pattern, livelihood and food security of households in urban under reserved settlement in Colombo district	Sri Lanka Food Composition data base, To improve the smallholder livelihood nutrition in Sri Lanka
5	Improving smallholder livelihoods and Nutrition: An evaluation of WFP's Nutrition-Sensitive Food for Assets Programm in Sri Lanka	Sri Lanka Food Composition data base, To improve the smallholder livelihood nutrition in Sri Lanka
6	Preliminary study to detect mutations in UL97 pen in suspected gancixlovir resistant CMV patitnts' samples	CMV resistance genes, New technology to detect COVID -19, Listeria resistance genes
7	New technology to detect COVID 19 (LAMP) method	CMV resistance genes, New technology to detect COVID -19, Listeria resistance genes
8	Molecular detection of antibiotic resistance genes in Listeria monocytogenes in field collected raw milk isolates from Plonnaruwadistrict in Sri Lanka, Arerospective study	CMV resistance genes, New technology to detect COVID -19, Listeria resistance genes

9	Structure activity relationship study of structural analogues of 6B- hydroxybetunolic acid as antimicrobial agents	
10	Evaluation of short term prognostic BNP in patients with acute heart failure	
11	Burdens of human leptospirosis and effectiveness of an intervention to minimize delays in seeking treatment among patients in Monaragala District	
12	Comparison of community acquired and hospital acquriedmethicllin resistant staphlococcusaureus in the national hospital of Sri Lanka	
13	Enhacement of early , rapid and definitive siagnosis of Leptospirosis together with study on risk factors in the district of Gampaha	
14	Comparirison of aminoglycoside, carbapenem&colistin by different antibiotic susceptibilty methods for Actintobactor	
15	Zebra Fish Egg Model as an indicator to environment Toxicity	Assessment of Environmental Toxins in selected water sources for CKDu in high disease prevalent areas in North Central Province using zebra fish egg model
National Aquatic Resource Research and Development Agency		
1	Deployment of submerged Fish Aggregating/ Enhancing Devices and bottom set structures for fish habitat enhancement in coastal waters	Deployment of FADs
2	To study the fishing efficiency of mono filament nets comparison with nylon nets used in inland reservoirs of sri Lanka	Production of environmental friendly fishing gear
3	Economics and strategies for profitable sea bass culture in lagoon net cages	Proper strategies for profitable sea bass culture in lagoon net cages
4	Integrated approach to efficient and sustainable intensification of food fish; Tilapia culture with aquatic plants (edible/ornamental) relation to different formulated feed regimes	Comparison of the quality formulae for Tilapia feed
5	Assessment of Fisheries and Aquaculture potential in floodplain ecosystems of Nilwala river basin	1) Baseline database of water quality in selected sites of Nilwala floodplain 2) Map (Zonal) plan for potential aquaculture in Nilwala Flood plain 3) Introduced appropriate aquaculture species/ practices for floodplain 4) Assessment of a reverie fishery and recommendations for management

6	Assessment of the impacts of climate change on selected vulnerable endemic and food fish species and their ecosystems and development of ex-situ conservation strategies	• Propose climate change adaption strategy for vulnerable endemic and food fish spp. of the island. • Baseline data on climate condition and reproductive performance of food fish species. • Induced breeding technology for Systomusasoka.
7	Monitoring disease conditions of shrimp aquaculture industry in Sri Lanka	Generate a data base on accurate information of the viral and bacterial pathogens circulating in the shrimp farming industry. • Aware farmers regarding the proper use of chemotherapeutants for disease management in shrimp culture. • The molecular diagnostic facility at NARA will be renovated mainly deal with related research on aquaculture bio technology.
8	Surveillance of Tilapia Lake viral infections in Wild and Farmed Tilapia species in selected farming areas	Reporting occurrence of pathogen.
9	Empirical modelling of benthic species distribution, abundance and diversity in Rekawa lagoon: scope for the future culture base fish production	Recommendations to culture based fisheries
10	Determination of sustainable carrying capacity estimation for culture based fisheries in selected perennial tanks in Southern Province –A case study in collaboration with NAQDA	Recommendation to stock fish juveniles
11	Assessment quality of fish in multi-day boats and in selected main fish sales places	Reports on quality of fish in newly made multi-day boats, water and ice; Central Fish Market and selected three sales places • Trained fisher community in primary fish handling and multi-day boats • Recommendations and technologies to mitigate fish quality losses and avoid contamination ice and water using in fisheries sector
12	Extraction and characterization of bioactive peptides from Tuna fish waste	• Preparation peptides using tuna fish waste • Evaluation report of Characterization of peptides (anti-bacterial properties ,antioxidant properties)
13	Application of Bio-Nanotechnology in value addition to aquatic resources	1. Nanoparticles materials from aquatic resources 2. Assessment of the biological applications of bio-nanoparticles in drug food and feed 3. Applicable techniques for industries

14	Prospecting sand resources in offshore ,Galle	• Surface geology of the area • Grain Size distribution map • Chloride ,shell and mineral content of the area • Sediment thickness map
15	Community welfare and skill development of fishers	Conduct 10 trainings for capacity development of the fishers Conduct 5 workshops for skills development of fishers
16	Zoning for mariculture development in northern province	1. Zonation map for marine cage culture, seaweed culture and sea cucumber farm 2. Final report
17	National Charting Program	Production of Nautical Charts
18	Modelling the spatial variability of tide in the Jaffna archipelago	Tide prediction methodology
19	Reason SeaBat 8101 backscatter data as a tool for sea bed characterization	Improved sea bed mapping technology
20	Market research of Tilapia fish Consumption (NAQDA/NARA include - cost benefit analysis for selected aquaculture species)	Reports on quantifying marine litters of the fishing boats for policy measures Reports on socio-economic impacts of marine litters of fishing boats Reports on fishers' perception on marine litters
21	Value chain Analysis of deep sea Fisheries in Sri Lanka	1. Mapped value chains for each considered fishery 2. Data base for cost of production of coastal and deep sea fisheries in Sri Lanka 3. Annual report including cost of production, value chain development, application of ICT status and potential of export market for studied fisheries
22	Sea urchin fishery development in Sri Lanka (Continuation)	Identify the distribution of the sea urchin Nutritional values of sea urchin Genomic identification of the species
23	Ornamental fish culture and feed development at Panapitiya Regional Research Center	Production of high quality fish feed
24	Study of optimal micro-habitat features for mariculture of the sea cucumber, Holothuriascabra in coastal waters of Sri Lanka	• Improve hatchery technology for economically important sea cucumber species • training and technical assistance • key

		habitats features for sea cucumber farming sites • Address and cater to the issues pertaining to sea cucumber farming
25	Biofloc Technology as an Integral Approach to Enhance Production and Ecological Performance of Sri Lankan Ornamental fish Aquaculture- Research project	1. Morphologically modified aquatic plant variety and seaweed variety. 2. Production of in vitro propagated aquatic plants
26	Modification of features of selected aquatic plants using somatic hybridization technique and in vitro propagation of seaweeds	Methodology to increase spat availability
27	Improving spat collection methods for commercial scale oyster farming and experimental reef restoration for enhancing the spat availability	Sustainable sea weed farming techniques
28	Establishment of seaweed farming by increasing culture diversity and ensuring mother stock availability.	Explore the pearl oyster resource Explore the culture conditions
29	Survey on natural pearl oyster resource in North West & North coasts regard to regain the pearl industry in Sri Lanka	• Assure the safety of bivalves • Minimize the development and spread of antimicrobial resistance
30	Sanitary survey of shellfish and monitoring of antimicrobial resistance in aquatic environment	Report on occurrence, risk and control of histamine forming bacteria in chilled fish in Multiday boats and fish processing plants
31	Investigation of incidences of histamine forming bacteria in chilled Yellowfin tuna (Thunusalbacares) in export fishery industry	• Seaweed culture practices can be enhance along the cost line of Sri Lanka. Seaweed can harvest both wild collection and cultured stock
32	Innovation of seaweed based value added product and evaluation of bioactive compounds	Recommendations to sustainably managed fishery
33	Assess the present level of harvesting of finfish/shell fish in Negombo lagoon for developing relevant fishery management strategies.	Scientific publications , Management recommendations
34	Spiny lobster fisheries management and in situ conservation of berried spiny lobsters	Scientific recommendations to sustainable fishery
35	Biological, fisheries and other aspects in shark fishery with a special reference to shark fin trade in Sri Lanka	Scientific recommendations to sustainable fishery
36	Study of flotsam associated fishery in offshore to Introduce management strategies for sustainable fishery.	Recommendations to sustainable fishery on flotsam associated fishery

37	Assessment and monitoring of small pelagic and large pelagic fishery resources via port sampling (continuous project)	Recommendations on small and large pelagic fisheries
38	Molecular based studies on feeding predation in commercially important fish species	PREY items, Publications and reports
39	Assessment of the blue whale population living in south coast of Sri Lanka and studying the interactions of marine mammals with fisheries	Scientific publications: Blue Whale catalogue Management recommendations
40	Sri Lanka – Norway Bilateral project to improve the management of the fish resources of Sri Lanka.	WP1 •Improved landing site data collection system • Trained and dedicated data collectors and managers • Centralized and integrated database on coastal fisheries WP2 • Scientific reports and publications • Fisheries management plans
41	Bio –physical monitoring of coral reefs and DNA bar-coding of coral species	Database on coral reefs and reef associated species. Status of the reefs and reef associated species. Scientific information for preparing management plans and policies . DNA barcoding database
42	Marine museum upgrade and skeleton preparation	Whale skeleton established to public Upgraded museum opened to public
43	Study on effect of bio accumulation and integrating ecological, carbon and water to tracking anthropogenic pressure on coastal lagoon and fresh water bodies (rivers & Reservoirs) to enhance ecosystem conservation	Possible outputs are new concepts. Also, provide recommendations to policy makers and support to decision making process under sustainable development in aquatic environment. In addition, these research findings will help to improve human health.
44	Study on Plastic and Polythene Debris in coastal waters around srilanka	1. Capacity building on monitoring of micro-plastics in sea water and beach sand 2.Report on abundance, distribution and characteristics polythene and plastic debris

45	Assessment of Climate Change Impacts on the Ocean Environment: Impact of Temperature, Salinity and Water Level on Coral Reefs in the East and the West Coasts of Sri Lanka	• In-situ temperature, salinity and water level dataset in east and west coast of Sri Lanka. • Major coral reef species composition in those two sites and their growth rate in natural environment. • Blended sea temperature, salinity and water level product. • Reports and scientific publications based on temporal and spatial ocean temperature variability around Sri Lanka and its impact on coral growth rates. • Coral mass bleaching prediction system for Sri Lanka.
46	Ocean Acidification and the Changes of Marine Carbon System in Sri Lankan Waters	5.3. Capacity building on monitoring station of acidity and alkalinity in sea water together with other in situ parameters in southern coastal water 5.4. Report on ocean acidification status in Sri Lankan waters. 5.5. Report on Seasonal variability of calcified phytoplankton with response to ocean acidification status
47	Sea level observation and formulation of oceanographic data base	• Sea level station established at all the sides of Sri Lanka • Sea level data net work established at NARA • Data to re-establish sea-level datum • Prediction of the short-term and long-term sea-level changes • Establishing a sea level data base • Developing infrastructure for sea level data/information system • Data manager for sea level data/information
48	Study of Marine Litter inputs from North western, Western, Southern and Eastern Marine Coastal areas of Sri Lanka. (Continuous Project)	Number of plastic and polytthne samples analyzed • Waste sources identified • Number of research papers/leaflet published
49	Identify the most appropriate fresh water fish bio indicator on freshwater ecosystem environment pollution	Recommendations on use of fish as bio indicators
50	Investigation of causes for emergency incidents such as oil spills, algal blooms and fish kills (Emergency studies)	Reports and recommendations on preventive measures for similar incidents.
51	Tuna fishing ground advisory and fisheries information service	Reports and recommendations on preventive measures for similar incidents.

52	Modelling of Coastal Sediment Dynamics and Coastal erosion on the North-eastern Coast of Sri Lanka.	1. Potential sediment transport pattern along North-eastern coast of Sri Lanka. 2. Erosional and depositional areas for the North-eastern region of Sri Lanka. 3. Spatial/temporal changes of grain size of beach profiles.
53	Fisheries Information Service - Fisheries Information Centre (FIC) of NARA	• Number of inquiries received from the hotline • Number of inquiries successfully solved • Number of promotional material developed and distributed • Number of industry analysis reports prepared
National Building Research Organization		
1	Determination of regional and local rainfall thresholds for landslides in Sri Lanka	Accurate landslide disaster prediction
2	Development of geotechnical guidelines for high-rise buildings	A guideline for high-rise building. (Introduce best construction practices)
3	3D Subsurface geotechnical mode for disaster resilience housing	Online database
4	Developing resilient construction manuals (Continuation)	Hazard resilient construction manual
5	Preparation of Technical Guidelines for Building Demolition work in Sri Lanka	A guideline for safer building demolition methodology
6	Development of cost-effective green masonry products using textile waste	Sustainable use of waste materials
7	Development of guideline for selection of materials and products for construction industry	Control entry of inferior quality building materials in the market.
8	Development of alternative fibers toasbestosfibres for roofing materials	Alternative solution for asbestos fibers as a roofing material
9	Analysis of waste sludge produced from water treatment plant as substitute for clay in the manufacturing of clay tiles.	Development of a clay tile
10	Suitability of Fly ash blended cement for construction of concrete water storage tank	Fly ash blended cement
11	Systematic diagnostic assessment of chemical disaster risk in Sri Lanka	Reduce chemical disaster risk

12	Analyzing the effect of meteorological, environmental and anthropogenic factors attributed to drought severity and sector-based water stress in Anuradhapura District	Develop a sustainable rainwater harvesting technologies

	National Engineering Research & Development Centre	
1	Industrial type coconut de-husking machine	
2	Rapid compost making method	
3	50Kg. vegetable dehydrator	
4	Coir braiding machine	
5	Device for measuring moisture content of tea leaves	
6	Machineries for Ayurvedic industry	

	National Institute of Fundamental Studies	
1	Earth resources and renewable energy	
2	Environmental Science research programme	
3	Evoluation, Ecology & Environmental biology	
4	Plant & environmental sciences	
5	Plant taxonomy &conservation	
6	Primate Biology	
7	Condensed matter physics & solid-sate chemistry	
8	Energy & advanced material chemistry	
9	Material processing & device fabrication	

10	Nanotechnology & advanced materials	
11	Bioenergy & soil ecosystem	
12	Microbial Biotechnology	
13	Rhizobium project	
14	Molecular Microbiology & Human Diseases	
15	Plant stress biology &molicular genetics	
16	Food chemistry	
17	Natural products	
18	Nutrition biochemestry	
19	Quantum physiscs& applied electronics	

	National Institute of Postharvest Management	
1	Design & Construction of a Tunnel Type Forced-air Cooler for Cooling of Fresh Mango	A cost effective method to remove field heat from fresh mangoes. - Low cost tunnel type forced air cooler. - Extended storage life of mango along with improved quality which will facilitate programmed year round marketing thus overcome market glut and price fluctuation. - Same mechanism can be applied to reduce postharvest losses of other fruits and vegetables also.
2	Evaluation of the chemical residues associated with artificial ripening and establish safe and economically viable dosing protocols for major fruit crops	To establish a safe and economically viable dosing protocol to minimize the hazardous effect of artificial ripening on consumers by increasing the market availability of good quality and safe fruits
3	Reduction of Postharvest Losses of Big Onion (*Allium cepa*) by Improved Curing and Storage Technologies	Reduction of onion postharvest loss, Increase the economic status of onion farmer High income trough offseason sales , Prolong storage period of onion to be used for the seed production

4	Investigation of Nutritional and functional Properties of Value Added Products from Sour sop (*Annonamuricata*)	Reduce the post harvest loss of soursop. - Introduce new food products produced from soursop to local food industry
5	Mitigating rice stickiness to enhance consumer preference through accelerated aging of fresh paddy	Mitigation of stickiness of freshly harvested rice while enhancing the consumer demand Introduction of alternative method for artificial aging of freshly harvested paddy to increase the quality of cooked rice
6	Enhancement of quality characteristics in dehydrated fruits by optimizing process parameters of dehydrating technologies	Improving quality characteristics of dehydrated fruits, as suitable to the export market, by manipulating various parameters involving in dehydrating process
7	Development of ready to use formulation for enhance the shelf life and quality of cut flowers	Develop ready to use formula to improve keeping quality of cut flowers, widely use in decorations
8	Development and performance evaluation of washing equipment for selected up country vegetables combined with ozone treatment	Fabrication of ozone assisted vegetable washer
9	Development of heat pump dryer for drying wet paddy.	Fabrication of heat pump drier for drying wet paddy
10	Field application of rice husk silicon to control pre-harvest and postharvest disease of bitter gourd and green chilies.	Reduce the pre harvest disease in green chili

Natural Resources Management Centre

1	Development of the Soil Atlas of Asia and National Soil Information Systems	National Soil Property maps
2	Identification of sources and transport of agrocontaminants in hilly agricultural watersheds in the declared conservation area in Sri Lanka	Find out the source and mode of transport phosphorus to water bodies in downstream areas.
3	Assessment of Atmospheric Nitrogen Pollution Sources, Impacts on Environmental Sustainability, Human Health and Remedial Measures in Three Unique Pollution Regions in Sri Lanka	Identify Sources of nitrogen pollutants in rain water in different locations
4	Seasonal and monthly agro-met advisories	

Office of the Registrar of Pesticides

1	Determination of pre harvest intervals of insecticides recommended against fall army worm and maize stem borer	Identified residue levels of pesticides in the crop

2	Incidences monitoring and occupational exposure study of highly hazardous Pesticide (HHPs) and severely hazardous pesticide formulation (SHPF) among farmers in Sri Lanka	Familiarize with tools for data collection on incidents caused by pesticide
Palmyrah Research Institute		
1	Formulation and standardization of a moisturizing, skin complexion improving facial gel /cream using palmyrah fruit pulp	Expansion of Palmyrah industry
2	Identifying and characterizing yeast species associated with Palmyrah toddy	Enhancement of various yeast related production in Palmyrah industry
3	Analysis of physical and chemical parameters of Palmyrah fruits for different morphological characteristics	Development of Germplasm sites
4	Developing a suitable method for the determination of authenticity of Palmyrah toddy	Introduction of authentic Palmyrah toddy of good quality
5	Identifying and quantifying vitamins available in Palmyrah sweet sap based products using high performance liquid chromatography	A procedure for analysis of vitamins using HPLC techniques will be available
6	Effect of Different Preservation Techniques on Chemical, Microbial and Functional Properties of Palmyrah Dried Seed Shoot Flour	Introduce Preservation Techniques for shoot flour
7	Formulation and standardization of noodles using Palmyrah tuber flour	Introduce Preservation Techniques for shoot flour
Plant Genetic Resources Center		
1	Dioscorea micro tuberization as a tool for long term conservation and planting material production	
2	Genetic diversity assessment and evaluation of selected crop wild relatives in Sri Lanka for crop improvement	
Plant Protection Service		
1	Development & dissemination of sustainable pest management technologies	Economically viable, effective and environment -friendly and safe pest management
Rice Research and Development Institute		
1	1.Development of new rice variety for 4 months	Develop high yielding 4 m variety with expected grain quality and pest disease reactions
2	2. Evaluation of Yield potential of newly bred promising lines against the recommended varieties under Preliminary Yield Trial	4 month high yielding rice variety
3	3. Evaluation of Yield potential of newly bred promming lines against the recommended varieties under Major Yield Trial	4 month high yielding rice variety

4	4.Purity maintenance and multiplication of elite lines	Maintain genetic purity of recommended rice varieties
5	5. Breeder seed production Varieties: Bg450, Bg 403,Bg 406,Bg 379-2	Breeder seeds
6	6. Development of new rice varieties tolerant to salinity	salinity tolerant rice lines with high yield, resistant to pests and diseases, and improved grain quality
7	1. Development of high yielding 3.5 months age rice varieties for favorable environments	New 3.5 months age rice varieties with high yield potential, non-lodging, acceptable grain qualities and resistant to major pest and diseases
8	2. Development of heat Tolerant rice varieties for	New improved rice varieties with heat tolerance
9	3. Development of Cold Tolerance rice varieties	New improved rice varieties with cold tolerance
10	4. Breeder seed production (Bg 352, Bg 357, Bg 358, Bg 359, Bg 360,Bg 366, Bg 369, Bg 370, Bg 94-1, Bg 374)	Genetically purified and certified breeder seeds
11	5. Multiplication of 3.5 months age rice promising lines (Bg 08-1407, Bg 11-802, Bg 14-567)	Genetically purified seeds
12	1. Development of high yielding 3 months age rice varieties for favorable environments	New 3 months age rice varieties with high yield potential, non-lodging, acceptable grain qualities and resistant to major pest and diseases
13	2. Development of rice varieties with low moisture stress tolerance	New rice varieties with low moisture stress tolerance
14	3. Development of drought escaping short age rice varieties (NRC project)	New drought escaping short age rice varieties with acceptable yield, non-lodging, acceptable grain qualities and resistant to major pest and diseases
15	4. Breeder seed production (Bg 300, Bg 310)	Genetically purified and certified breeder seeds
16	5. Multiplication and maintaining the genetic purity of recommended 3 months age rice varieties and promising lines (Bg 304, Bg 305, Bg 301, Bg 34-8, Bg 276-5, H10, Zhonghua, Bg 11-1051, Bg 14-2374, Bg 14-2448)	Genetically purified seeds
17	1. Development of 2 ½ month (ultra-short age) rice varieties	Develop high yielding 2 1/2 m variety with expected grain quality and pest disease reactions
18	2. Breeder seed production	4 bushals of breeder seeds from each variety
19	3. Evaluation of Yield potential of promising lines a. Preliminary Yield Trial(PYT)b. Major Yield Trial (MYT)	select best lines to test in CRVT (3 lines)
20	4.Purity maintenance and multiplication of elite lines	200Kg from Bg 13-1265 and 40 Kg per each other line

21	5. Development of BPH resistant rice varieties through Marker Assisted Breeding program	Advanced rice lines with BPH resistance
22	1. Development of new improved quality rice varieties with acceptable yield	Local and export market accepted new quality rice varieties
23	2. Evaluation of new elite rice lines in preliminary yield trial (PYT)	High yielding quality rice lines with pest and disease tolerance for further evaluation in MYT
24	3. Evaluation of promising rice lines in major yield trial (MYT)	High yielding quality rice variety with pest and disease tolerant for further evaluation in NCRVT
25	4. Development of early drooping rice variety for integrated weed management	New rice varieties with early drooping characteristics for integrated weed management
26	5. Multiplication and maintaining the genetic purity of promising rice lines (7 promising lines)	Genetically purified seed lot
27	6. Evaluation of parental materials belongs to all age categories	To evaluate the genetic effect of selected characters in each variety
28	01.Development of new hybrids through heterosis breeding	Develop hybrid with high yielding resistant to biotic and a biotic conditions
29	02.Evaluation of crosses combinations in test cross nursery	Selection of promising CMS lines, Restores and Hybrids for the further development
30	03.Preliminary yield trial (PYT)-Exotic Hybrids	Select high yielding lines
31	04.F_1 seed production of promising hybrid	To introduce hybrid seeds for farmers
32	05.Nuclear seed production	Produced required amount of CMS seeds
33	06. Small scale seed production	Produce F1 seed of new hybrids
34	07.Preliminary yield trial (PYT)-Local inbreed restorer line	Select high yielding lines
35	08.Development of new male sterile rice lines via wide hybridization	Select of new male sterile lines for rice hybrid production
36	09.Screening of new restorer lines	Select high yielding and better performing lines
37	10.Screening of new lines for cold tolerance	Select high yielding and better performing lines for cold tolere.
38	1. Germplasm multiplication and conservation	750 accessions multiplied and conserved in short term cold storage
39	2. Purification of selected traditional rice cultivars	3 bushels of purified seeds of each variety
40	3. Development of quality rice varieties through mutation	3 promising lines with good quality
41	1. Incorporation of AG1 gene into Bg 366 through MAS	Rice variety Bg366+AG1 with capability of anaerobic germination for direct seeding areas
42	2. Incorporation of Sub1 gene into popular varieties (Bg 455, Bg 379-2, Bg 360, Bg 358)	Improved lines for abiotic stress tolerant of popular varieties having comparable yield with their recurrent parents.

43	3. Development of Drought tolerant introgression lines of popular two varieties	Drought tolerant high yielding lines of popular varieties
44	4. Development of drought tolerant / escape lines	Drought escape or tolerant varieties for drought prone areas
45	5. Development of BPH and BLB resistant rice lines	BPH resistant rice lines ,BLB resistant rice lines
46	6. Calli mediated mutation breeding using chemical mutagen	1. White pericarp rice variety with At 362 plant characters . 2. High yielding long slender rice varieties
47	7. Pyramiding of BLB and Blast resistant genes in rice	BLB and Plast resistant rice lines
48	8. Development of grain quality by grain shape and incorporation of fragrance in rice	Fragrant rice lines with good grain quality
49	9. Development of Phosphorus deficiency tolerant rice varieties	P efficient rice lines
50	10.Identification and confirmation of Gall midge resistant rice varieties/ lines available in Sri Lanka	Identification of Gall midge resistant rice variety/line
51	11.Maker Assistant breeding of Gall midge resistant rice line/ variety	High yielding and Gall midge resistant rice line variety for
52	1. Testing of promising rice lines in low county intermediate zone - (NCRVT)	New rice lines for regional /national cultivation
53	2. Adaptability testing of promising rice lines (VAT / LSVAT)	New rice lines for regional /national cultivation
54	3. Multiplication of abioitic stress tolerant lines	50 kg of seed stock
55	4. Adaptability testing of new cultural / farming practices for rice cultivation in Polonnaruwa district	Information on promising cultural / farming practices with special emphasis on their adaptability
56	5. Multiplication of cold tolerant lines/varieties	5-10 kg seed stock of each variety/line
57	6. Evaluation of cold tolerant rice varieties for yield and agronomic characters	3-4 varieties/lines with low temperature tolerance
58	7. Screening of selected rice lines for drought tolerance	3-5 drought tolerant lines
59	8. Screening of rice varieties and lines for heat tolerance	2-3 heat tolerant rice varieties & lines
60	9. Evaluation of selected rice varieties and management options for mechanical transplanting (4 trials at research & farmer fields)	An agronomic package for mechanical transplanted rice
61	10. Effect of seeding rate for growth and yield of mechanical transplanted rice	An agronomic package for mechanical transplanted rice
62	11.Evaluation of selected varieties and management options for rice germinated in standing water condition	A suitable management package for AG tolerant varieties
63	12.Evaluation of weed management options for rice germinated in standing water condition	A suitable management package for AG tolerant varieties

64	13. Screening of rice varieties for ability to germinate in standing water condition	At least 5 lines with anaerobic germination tolerance
65	1. Long term effect of P application on soil P content and grain yield of rice	Effect of different methods of P application on soil P content and grain yield of rice will be identified
66	2. Long term effect of application of organic manure and chemical fertilizer to rice fields	Importance of organic manure application to sustain productivity inn paddy fields will be estimated
67	3. Nitrogen response of elite breeding lines	Information on nitrogen response of elite rice lines will be made available to breeders
68	4. Long term effect of K fertilizer on soil and plant K content in rice cultivation	Importance of K fertilizer application in rice cultivation and most suitable method of K application to improve K use efficiency will be understood
69	5. Maintenance of rice fields without application of chemical fertilizer or organic manure	Soil fertility and grain yield changes in paddy fields without application of manure or fertilizer
70	6. Development of site-specific fertilizer management systems for sustainable crop production (FAO Project)	Applicability of soil and plant test kits for the application of fertilizer based on soil and plant analysis for optimum crop production.
71	7. Development of eco-friendly farming technologies to minimize inorganic fertilizer usage while maintaining adequate productivity and improving soil fertility (NRC Project with UOP and RRDI)	Response of rice to N P and K fertilizer at different levels of soil fertility were identified.Bacterial inoculants will be identified as potential bio fertilizers
72	8. Development of Sri Lankan Rice Germplasm in storing micronutrients and heavy metals in rice grains and potential of agronomic management in fortifying rice grains with micronutrients (IFS Project with UOP and RRDI)	micronutrients and heavy metals in polished and non polished rice grains cultivated in the fields without application of chemical fertilizer or organic manure and +G460:G468with the application of fertilizer will be identified.
73	9. Fertilizer recommendation for ultra short aged rice varieties	A new fertilizer recommendation for ultra short aged rice varieties for optimum rice yield.
74	10. Study the nutrient availability in soil and plant with different moisture/water level in paddy fields	Information on nutrient availability in soil and plant with tested irrigation methods
75	11. Evaluation of new fertilizer materials issued by fertilizer testing committee on paddy cultivation for field trials	Promising fertilizer
76	12. . Evaluation of new fertilizer materials issued by fertilizer testing committee on paddy cultivation for field trials	Promising fertilizer
77	13. Need based use of fertilizer inputs in the food crop sector	The best combination of fertilizer
78	14. Evaluation of bio-film bio fertilizer on growth and yield of rice	Best combination of bio-film bio fertilizer and chemical fertilizer

79	15. Study the performance of selected popular traditional rice varieties under organic condition	Suitable traditional rice varieties under organic condition
80	16. Study the effect of glyricidia on weed management of rice under organic condition	The suitable rate of glyricidia
81	1. Effect of temporal variation of climatic condition on irrigated rice cultivation	Suitable sowing dates under irrigated condition
82	2.Effect of the temporal variation of climatic condition on rainfed rice cultivation	Suitable sowing dates under rainfed condition
83	3 Effect of the application of AWD during flowering of rice	The most appropriate method of AWD for irrigation during flowering of rice
84	4. Effect of soil moisture at different tension levels during vegetation period in rice cultivation	The most suitable irrigation interval during vegetative phase
85	5. Preparation of soil P map for Polonnaruwa, Anuradhapura and Kurunegala districts	Soil fertility maps for Polonnaruwa, Anuradhapura and Kurunegala and districts
86	1. Study of Seasonal Variation of Paddy bug (Leptocorisaortorius)	Paddy bug forecasting to avoid epidemic
87	2.Development of a management system for rice field rats in Sri Lanka based on their diversity, ecology, reproductive behavior and societal impact	Development of a management system for rice field rats
88	3.Evaluation of effectiveness of insecticides against major rice pests	Recommend the new insecticide for major rice pests - thrips - paddy bug - leaf folder - mites - stem borer - brown plant hopper
89	4. Evaluation of pest incidence of different establishment methods	Suggest the most suitable establishment method for minimize the pest damages
90	5. Study of identification of relationship between whorl maggot damage and white spikelet occurring with relation to climatic variations	Find whether there is any influence of damage severity of whorl maggot d to the occurrence of white spikelet
91	6.Development of *Bacillus thuringiensis* (Bt) Microbial Pesticide to control Major Rice pests	Suggest the most suitable Bacillus thuringiensis (Bt) strain to control the major rice pests
92	7. Evaluation of chemical constituents present in volatile compounds isolated from rice for egg laying behavior of paddy bugs.	Identification of influential chemical constituents in rice for egg maturity of paddy bug.
93	8. Re-evaluation of already recommended rice varieties and traditional rice varieties for BPH	Current status of different rice varieties for reaction to BPH will be confirmed.
94	9. Evaluation of silica containing products as nutrient cum plant-resistance inducers for thrips, Leaf Folder and BPH in rice.	Plant resistance inducers are identified as alternative pest management strategy
95	10.Screening of NCVT rice lines / breeding lines for resistance to Brown plant hopper (BPH)	Sources of resistance to Brown plant hopper

96	11.Screening of NCRVT rice lines / breeding lines for resistance to Rice Gall Midge (RGM)	Sources of resistance to RGM
97	12. Impact of crop/ pest management practices adopted by farmers in major rice growing areas in Sri Lanka on activity of egg parasites of BPH	Status of parasite activity in relation to different crop and pest management practices.
98	13. Testing of Pheromones traps for rice stem borer and leaf folder	Pheromone traps for control of yellow stem borers and Leaf folder
99	14. Identification of insecticide resistance status of BPH found in Ampara Dist. against insecticides belongs to neonicotinoid groups	Efficient BPH control by developing an insecticide resistance management program
100	15.Utilization of Kairomones from mature-rice plants for mass trapping of paddy bugs	Identify the kairomones responsible for attracting paddy bug and bugs' egg maturity
101	16. Investigations on the factors relevant to the recent Rice Stem Borer outbreak in Polonnaruwa district during 2018 to initiate an early warning system	Find out the factors responsible for the recent Rice stem borer outbreak
102	17. Study on the level of resistance of variety Bg 310 for Rice gallmidge	Identification of level of resistance and whether a new RGM biotype has emmerged
103	01.Investigation of pathotype diversity of the bacterial leaf blight pathogen *Xanthomonasoryzaepvoryzae* in Sri Lanka	Number of different pathotypes
104	02.Investigation of fungicide for grain discoloration	Fungicides
105	03.Screening of rice breeding lines for bacterial blight resistance	Resistant rice lines
106	04.Screening of rice breeding for blast resistance	Resistant rice lines
107	05.Screening of new source of fungicide against rice blast	Fungicides
108	06.Screening of new source of fungicide against rice sheath blight	Fungicides
109	07.Isolation & identification of rice blast diseases suppressing bio control agent from the soil	An antagonistic bacterial strain
110	08.Identification of seed borne fungi and its effect on grain quality of rice in Kurunegala district	Number of seed born fungi Grain quality properties changes due to seed borne fungi
111	01.National co-ordinated rice herbicide testing program	Bio-efficacy values of candidate herbicides to be recommended
112	02.Re-evaluation of effectiveness of recommended herbicides for rice cultivation	Maintain the quality standard of already recommended herbicides
113	03.Evaluation of weed suppressive ability of new promising rice lines	Weed suppressive varieties
114	04.Evaluation of Phyto-toxicity effect of recommended herbicides on different rice varieties	Identify the Phyto-toxicity of different herbicides

115	05.Evaluation of bio-efficacy efficacy of different rates of Bispyribac sodium herbicide (Nominee &Kensolo)	Identify effective rate of Nominee &Kensolo herbicides
116	06.Study on effect of phyto-toxicity of Hebrides on yields of ultra shortage rice varieties	There was no significant eeffect of phyto-toxicity of herbicides on grain yields of selected ultra shortage rice varieties
117	07.Weed management through soil seed bank depletion technique by alternate poly mulching	Eco-friendly weed control practice
118	08.Evaluation of weed control efficacy of different herbicides under rain-fed condition	herbicides work under rain-fed condition
119	09.Evaluation of different sprayers for herbicide spraying in rice cultivation	Best Sprayer and nozzle for herbicides
120	01.Evaluation of nutraceutical and health properties of popular traditional and improved rice varieties	Data on nutraceutical and health properties of locally available germplasms
121	02.Evaluation of grain quality characteristics of different breeding materials under low moisture and normal irrigated environmental condition	varieties and breeding lines for future breeding programs based on quality characters
122	03.Effect of vacuum packaging and storage condition on rain characteristics of selected rice varieties	Performance in relevance to grain quality characters of selected breeding materials under different environmental conditions
123	04.Evaluation of grain quality characteristics of advanced breeding material and NCRVT entries	Consumer preferred, quality ensured vacuum pack to enhance the shelf life of grain than ordinary packaging methods
124	05.Evaluation, multiplication and selection of exotic germplasm (imported from Bangladesh)	NCRVT entries and advanced breeding materials with elite grain quality characters
125	1. Improvement of high yielding rice varieties	Improvement of promising rice lines with expected qualities which are suitable for yield testing at the research centre
126	for LCWZ through conventional breeding technique	Selection of few promising rice lines having submergence and iron toxicity tolerance
127	2. Improvement of rice varieties for submergence and iron toxic conditions	
128	3. Testing Yield Potential of Promising rice lines	Selection of good performing promising rice lines for NCRVT programme
129	4. Breeder seed production of recommended Bw rice varieties	Required amount of Breeder seeds of Bw 367, BW 372
130	5. Seed Purification of Promising lines	Pure seeds of NP BLB 72-1,NPBLB99-2-1,NP BLB93-1-11,Bw 17-861,Bw 17-908,Bw 17-926,Bw 17-953,Bw 17-1577,Bw 17-971,Bw 14 820,Bw 14-903,Bw 14-523,Bw 14-764,Bw se.14-1806,Bw se.14-1721,Bw 15-501,Bw 15-519, NP 14-4-1 and NP 14-5-1 400kg of Bw 11-3403, 60 kg of Bw 12-574,30 kg of 14-509,30 kg of 15-3-1322,30 kg
131	6.Seed Multiplication of Promising lines	

		of 15-971, 9 and quality seeds of Bw 400, Bw 451, Bw 452, Bw 453 and Bw 351, Bw 302 and Bw 364,Bw 367,Bw 372
132	7.Supply of quality seeds of selected traditional rice varieties	Quality seeds of Suwendel, Madathawalu, Behethheenati, Mahamaa wee, Kuruluthuda and Herathbanda
133	8. The sixteen International Rained Rice Observational Nursery (IRLON 2018)	Selection of good performing rice lines under the local conditions
134	01.Identification of suitable Bw rice varieties for machinery transplanting	Identification of most suitable rice variety for machinery transplanting
135	02.National coordinated rice varietal test (NCRVT)	Rice lines with better performance
136	03.Varietal adaptability testing (VAT)	Rice lines with better varietal adaptability
137	04.Testing nitrogen response of promising Bw rice line	Rice line with better nitrogen response
138	To identify the suitable fertilizer materials for rice	Suitable new fertilizer materials for rice
139	To study the long term effect of applied fertilizers on grain yield and soil chemical properties	Suitable fertilizer management system will be identified
140	To select the time of fertilizer application for ultra short aged rice varieties	Fertilizer recommendation for ultra-shortage varieties
141	To enhance the grain yield of rice	Suitable rate of S will be identified to increase grain yield
142	To identify the Zn application method to increase grain yield	Suitable Zn application methods will be identified to increase grain yield
143	To identify plant extract as potassium source for rice plant	Straw extract as potassium source
144	To introduce the soil test kits to farmers to analyze the soil on farm for application of fertilizer	Suitable soil test kits will be identified
145	To identify suitable fertilizer materials for rice	Suitable new fertilizer materials for rice
146	To calibrate the present fertilizer recommnedation	Calibrated fertilizer recommendation
147	1.Evaluation of silica containing products as nutrient cum plant resistance inducers for thrips	Plant resistant inducers are identified as alternative pest management strategy
148	2.Screening of NCRVT rice lines for BPH	Sources of resistance to BPH
149	3.Honey dew test for BPH	Sources of resistance to BPH
150	4. Screening of NCRVT rice lines for gall midge	Sources of resistance to gall midge
151	5.sceening of breeding lines for BPH	Sources of resistance to BPH
152	6.sceening of INGER for BPH	Sources of resistance to BPH
153	7. Screening of traditional rice varieties for rice sheath mite	Sources of resistance to rice sheath mite

154	1.Study on grain discoloration of some important rice varieties and their effect on seed germination and seedling vigour	Effect of grain discolation to germination and seedling vigour in different ricevarieties
155	2.Screening of breeding lines, NCRVT lines, INGER for BLB	New BLB resistant sources
156	3. Screening of NCVT rice lines / varieties , promising breeding lines & INGER for blast disease	new blast resistant sources
157	4.Evaluation of silica containing products as nutrient cum plant resistance inducers for brown spot disease	Plant resistant inducers will be identified as alternative disease management strategy
158	1.Study the effect of water management and appropriate time of power weeder application on weed control in machinery transplanted rice	Proper weed control method in machinery transplanted rice
159	2.Evaluation of anaerobic germination trait incorporated rice lines to determine the germination and seedling development under field submerged condition	Identification of rice line for water seeding with anaerobic germination ability
160	3.National coordinated herbicide test(NCHST)	Identification of new effective herbicides
161	1.Evaluation of different rice lines/ germplasm for upland cultivation	Rice line suitable for upland cultivation
162	2.Identification of effective weed control method for upland rice cultivation (Sorjan beds)	Suitable weed control method for upland rice cultivation
163	3.Generation of a fertilizer recommendation for ultra-shortage rice verities	Fertilizer recommendation for ultra-shortage rice verities
164	4.Evaluation of promising rice lines under NCRVT program	Rice lines with better performance
165	5.Evaluation of promising rice lines under VAT program	Rice lines with better varietal adaptability
166	6.Production of commercial seeds of Bg455, Bw372, Bw367,Suwdal and Bg38.	Commercial Seed paddy from each varities
167	7.Screening of promising rice lines for submergence and saline condition (Collaborative study with Labuduwa)	submergence and salinity tolerant rice lines
168	1.Response of Rice (Oryza sativa. L) to different methods of Zn application in low country dry zone in Sri Lanka	To identify the effect of Zn on the growth yield and grain quality improvement of rice
169	2.The response of different rice verities to different N levels under direct sowing	To identify the nitrogen response of newly developed rice variety and optimum level of nitrogen for crop yield
170	3.Development of new fertilizer recommendation for ultra-short age rice varieties	To identify new fertilizer recommendation for short age plants
171	4.NCRVT trial	To select rice adaptable rice lines
172	5.VAT trial	To evaluate the yield variation under different climatic zones To evaluate the yield variation under minor irrigation
173	1. Development of improved rice varieties through Conventional breeding methods	Development of high yielding short duration rice varieties with red pericarp,

		salt tolerance, good grain quality, insect pest and disease tolerant
174	2. Evaluation of yield potential of promising rice breeding lines	Selection of high yield potential rice breeding lines with good agronomic traits
175	3. Breeder seed production	Required amount of breeder seeds of recommended 13 'At' varieties will be produced. At 303 – 3m, Red LM At 306 – 3m, White Basmathi At 307 – 3m, white, IB At 308 - 3m, white, SR At 309 – 3m, White, LS At 311 – 3m, Red, LS At 373 – 3 ½ m, SR At 353 – 3 ½ m, Red, LM At 362 - 3 ½ m, Red, LM At 354 – 3 ½ m, white, LM, salinity tolerant At 401- 4 m, Red, LM, salinity tolerant At 402 – 4m, Red, LM At 405 – 4 m, Whit, Basmathi
176	4. Multiplication of promising breeding lines	Genetically purified seeds will be produced. Pipeline varieties At 09-898 – 3 ½ m White SR LSVAT At 10-1374 - 3m Red LS VAT At 13-2715 - 3m Red LS NCRVT At 13-1532 - 3m Red LS At 14-797 – 3m White LM
177	1. *In vivo* glycemic index (GI) of improved and traditional varieties of rice in Sri Lanka and its relationship with *in vitro* GI and other important grain constituent and their heritability estimates	The results will reveal the exact nutritional composition and glycaemic index of rice varieties. These values will be useful to the rice breeder to breed new varieties which consist of health benefits and study will give useful details to the national consumer, the rice producer as the rice breeder and to the scientific community
178	2. Screening of MYT and PYT trials for grain quality attributes	Screened varieties to provide the rice breeders
179	1.Response of rice and weeds to submergence during germination and early growth	Selection of suitable varieties to submerged conditions and To estimate the weed control % with submergence

180	2.Response of rice genotypes to weed competition in wet DSR	Identification of weed competitive rice variety
181	3.Assessment of status of weed management in Hambantota district.	Identification of weed management practices and herbicides usage in Hambantota district and identification of yield losses due to weeds.
182	4.Evaluation of herbicide resistant *Cyperusdifformis* and *Cyperusirri*population in DSR in Hambantota district	Identification of weed management practices and herbicides usage in Hambantota district and identification of yield losses due to weeds.
183	5. Evaluation of different sprayers for herbicides application	To identify suitable sprayer type to achieve high efficacy of herbicides,
184	6. Screening of popular samba type rice varieties against to phytotoxicity of available herbicides.	To identify suitable rice varieties for different herbicides.
185	1. Rice variety improvement for high potential rice lands of LCWZ	2-3 new varieties
186	2. Improvement of rice varieties for the salinity affected flood prone soil conditions of Low Country Wet Zone	Salinity and submerge tolerant rice varieties
187	3. Development of thrips tolerant rice varieties	Thrips resistant improved rice varieties
188	4.Identification of suitable traditional rice varieties, documentation of farmers knowledge and strengthening of seed flow network of traditional rice in Low Country Wet Zone	Identified few traditional rice varieties match for the LCWS and strengthen the seed flow network of them
189	5. Breeder seed production	Breeder seeds of Ld 365, Ld 408, Ld 368 Ld 371, Ld 253
190	02. Evaluation of selected rice varieties for aerobic rice cultivation in Low country wet zone	Better rice varieties for aerobic cultivation in LCWZ
191	03. Long term soil fertility monitoring in RRS Labuduwa	Seasonal changes of basic soil properties in selected site
192	04. National Coordinated rice variety testing trials	Identified adaptable and better performing rice varieties for LCWZ
193	05. Testing of new varieties-Variety Adaptability test (VAT)	Identified adaptable rice varieties for LCWZ
194	1. Evaluation of advanced breeding lines from the crosses of Dahanala with Ld 368, Bg 9024, Bg 300 short age varieties for the resistance of thrips. (Contin.)	Thrips resistant short age rice variety
195	2. Pest forecasting trial for rice sheath mite	Population dynamics of Rice sheath mite and forecasting model for Rice sheath mite.
196	3. Evaluation of IRRI Rice varieties and lines for BLB	BLB resistant rice lines
197	4.Screening of advance Breeding lines for the resistance of Brown spot	Brownspot resistant rice lines
198	5.National Coordinated Herbicide Screening (NCHST) Trial for wet-seeded rice	Effective herbicides to control weeds in low country wet zone

199	6.Identification of better performing, BLB tolerant lines through yield testing from INGER nurseries	Better adaptable BLB tolerant lines for breeding and releasing purpose
200	1. Testing of promising rice lines in low county dry zone -(NCRVT)	New rice lines for regional /national cultivation
201	2.Testing of yield performance of promising rice lines	New rice lines for regional/national release
202	3. Effect of BPH attack in different stages in different varieties of rice in Ampara District.	very essential for building up a successful BPH management system
203	4. Bio-efficacy evaluation experiments of candidate herbicides	New efficient herbicides for national recommendation
204	5. Field validation of improved IWMP by combining weed competitive cultivars	Field validated improved IWMP
205	6. Weedy rice problems and solutions for its management in Ampara District	Pro To reduce weedy rice problems in the Eastern Region of Sri Lanka.
206	7. Evaluation of performance of short and long term Rice Varieties In-Order to Avoid Drought Period	Decide what short duration rice varieties are suitable for water scarcity area
207	8. Adaptation testing of promising drought tolerant lines	Promising rice lines with drought stress tolerance and adaptability
208	9. Multiplication of promising drought tolerant lines	Confirm the quality seeds to popularize
209	1 Purification of local land races of rice in northern region	To obtain purified seeds of traditional rice varieties
210	2. Evaluation of selected locally ,collected popular rice lines for yield and the grain quality characters	Few rice lines having high yield with good grain quality for hybridization
211	3. Development of high yielding resistant to major pest & disease consumer preference to region, short-intermediate duration red rice varieties	Promising new improved elite lines with desirable traits
212	4.Development of high yielding consumer preference to region, short duration red rice varieties for rainfed condition	Promising new improved elite lines with desirable traits
213	5. Evaluation on different spacing on growth and yield performance of rice by using transplanter machine	Finding the optimum spacing for machine transplanted rice
214	1. 6.Evaluation Experiments of Different Herbicides Application Control Weeds in Rice Cultivation.	Promising new herbicide for controlling different types of paddy weeds
215	7. Effect of Different Rice Establishments Methods	Proper Establishment Methods in rice cultivation
216	8. Testing of promising rice lines in low county intermediate zone - (NCRVT)	New rice lines for regional /national cultivation
217	9. Comparing the Different Organic Fertilizer with Inorganic Fertilizer	Finding best eco-friendly fertilizer giving optimum yield in rice cultivation.
218	10. Seed production	Pure seeds
219	11.Effect of Different Mulching with Alternate Wetting and Drying	Identifying the high yield performing mulching practices and water level

220	12. Selecting suitable high yield promising rice varieties in northern region	Selecting the best varieties for northern regional cultivation
221	13.Testing the Varietal adaptability in dry zone (VAT)	New rice varieties for regional cultivation
222	14. Evalution on different depths of planting of growth and yield performance of rice using transplanter.	find out the optimum depth of planting for machine transplanted rice
223	15. Influence of Organic Pesticides on Growth and Yield of Selected Rice Varieties in Northern Region	Eco-friendly Pest Control with optimum yield in rice cultivation
224	16. Bio-Efficacy Evaluation Experiment of Candidate Herbicides	Evaluation Bio-Efficacy of Herbicides
225	17. Influence of *Azolla* in Rice Growth and Yield	Finding the effect of *Azolla*in rice production and recommend the level.
226	18. Effect of Seedling Age on Growth and Yield Responses of Machine Transplanted Rice.	Finding the optimum seedling age for better growth and yield in machine transplanted rice
227	19.Effect of different Weed Control Methods in Machine transplanted rice	Promising new weed control methods for reducing the weed effect in rice cultivation
228	20.Application of Special Fertilizer Products for Pot Cultivation in rice	Finding Proper fertilizer products for pot culture.
229	21.Identification of Suitable Weed Control Methods in Dry Drilled Seeded Rice	Proper weed control method
Rubber Research Institute of Sri Lanka		
1	Breeding selection and evaluation of new genotypes using conventional strategies	Release 01 clones to the recommendation Add 05 genotypes to large scale trials Release 01 clone for smallholders Develop 02 yield indexes for clone evaluation
2	Use of Molecular biology strategies to Increase the production and productivity of rubber	Characterize 01 genes Recommend 02 drought tolerant clones
3	Improvement of nursery and propagation techniques, field establishment and immature upkeep	Three chemicals and one plant extract (botanical) tested, one technique for short term seed storage recommended
4	Intercropping diverse crop species with rubber for land productivity improvement, additional income generation and environmental sustainability	Two new crops tested for their suitability to grow under rubber
5	Training and trouble shooting in planting, tapping and intercropping	Thirty advisory visits made, twenty tapper training programmes, ten bud grafting and intercropping programmes conducted

6	Testing of different harvesting systems for sustainable utilization of bark and productivity improvement	Two improved tapping techniques tested,One botanical formula and two chemicals tested for their alleviating effect on TPD incidence
7	Evaluate the effectiveness of environmental friendly agro-management practices for enhancing fertility in rubber soils	1. Apply different techniques to enhance soil fertility and fertilizer use efficiency in rubber soils (7 techniques) 2. Revise the recommendations for rubber (one recommendation) 3. Establishment of demonstration plots based on rehabilitation of degraded rubber lands by using environmental friendly agro-management practices (2 demonstration plots) 4. Apply different mulching techniques to control weeds effectively (2 techniques)
8	Introduction of new fertilizer mixtures for nontraditional rubber growing areas	1.Develop databases based on soil and plant parameters (3 databases)
9	Issuing certification for land suitability, site specific fertilizer applications and analyzing fertilizer samples	1.Issuing site specific fertilizer recommendation reports &total extent of survey land (45 reports & 5000ha of extent) 2.Land suitability reports & total extent of survey land (5 reports & 250 ha of extent) 4.Analytical reports & parameters analyze (150 reports & 4000parameters)
10	Screening of chemicals to control diseases and clones to identify disease resistant clones	Revision of chemical recommendations – 01 Introduction of annual disease severity levels of different clones against Oidium / Phytophthora / Corynespora
11	Studies on the biology and molecular biology of pests	Publications on the biology of pathogens 02 Publications on the molecular biology of pathogens 02
12	Studies on beneficial microbiology to explore methods to promote small scale cottage industries and to strengthen the microbiological testings	Recommendation of a bio pesticide - 01 Commercialization of a biopesticide – 01 Expansion of beneficial culture collection and identification of growth

		promoting rhizobacteria from rubber growing soils
13	Surveillance of potential pests and disease outbreaks to avoid unwanted sudden disease epidemics Advisory & Training Programmes	Record of new diseases Record of new alternative hosts for the existing diseases Tracing any disease outbreaks to avoid sudden disease epidemics Training programmes -08 Advisory visits to solve all the requested complicated problems
14	Research, development and commercial introduction of low intensity harvesting strategies	Level of development % Level of introduction%
15	Research and development on biochemical and physiological aspects to improve the sustainability of rubber farming	Level of clonal testing% Agro-ecological zones covered% Level of developing a new method % Level of identification%
16	Expansion of rubber cultivation	Protocols for the rubber cultivation in dry zone developed Socioeconomic impact of rubber cultivation in Eastern Province assessed New areas suitable for rubber cultivation identified
17	Increase the land productivity through the technology adoption	Application frequency of new animal repellent for the intermediate zone identified On farm productivity and variability among smallholder rubber farmers inKegalle district identified Willingness to accept bee keeping by rubber smallholders identified
18	Improving the reliability of interpretations through appropriate statistical methods	Support for scientists in experimentation, data analysis & interpretation – 60 research trials/surveys Improvement of interpretations through development, modification and application of appropriate statistical methods – 2 applications & subsequent publications

19	Improving the knowledge base on climate, climate change & variability for better decision making in rubber growing areas	Dissemination of research outputs to the scientists for better decision making, information for policy makers – 2 publications Improvements in 4 meteorological observations
20	Analysis on Socio-economic implications & sustainability issues of rubber cultivation with Different policies implemented in the rubber sector	Rubber industry growth indicators including Rate of Growth, Revenue generation, International Trade indicators Poverty indicators of small holder rubber farmers in different rubber growing districts and sustainability indicators Sustainability indicators of rubber based farming systems Provision of policy recommendation to the industry
21	Rubber Industry data management	Recommendation made by the analysis, Data bases were made available to the industry
22	Strategic technology transfer approaches to improve the productivity of the smallholder sector	No. of farmers and estates successfully adopted key recommendations in identified areas No. of established model lands, model villages and demonstrations
23	Transfer of technologies developed by the RRISL to improve the productivity of estate sector	No. of clearings successfully adopted key recommendations is in identified areas (50 clearings) No. of established demonstration plots and model clearings (50 demonstration plots)
24	Improvement for advisory services	No. of decisions conveyed to extension managers
25	Human resource development of all stake holders of the rubber sector	No. of farmers, estate managers, estate field staff and workers successfully trained No. of successfully conducted awareness and training programmes
26	Development of effective extension network in the rubber sector	Establishment of 03 Technology transfer centers Establishment of a Techno-Park

27	Development of Novel manufacturing Technologies for raw rubber manufacture	i. Introduce five modified SS tanks to the small scale farmers ii. One Commercial viable method for Low protein contained NR latex & shelf life time improved PVNRL iii. One pilot scale mechanized manufacturing process for RSS iv. Adaptation of one swift set smoke house (10 kg capacity) Performance study on different water reuse protocols
28	Preparation and characterization of Skim rubber/Plastics	Processing conditions for Skim/Plastic dynamically vulcanized blends Mechanical properties of vulcanized blends
29	Development of raw rubber blends based formulations for specific applications	Preparation and performance evaluation of composites
30	Assessment of efficiency of present anaerobic-aerobic rubber effluent treatment system and its modification to suit to smallholder sector	i. Report on efficiency of present rubber effluent treatment system available in raw rubber manufacturing industry. ii. Pilot scale treatment plant for small holder sector
31	Quality improvement & quality assurance of latex, raw rubber and rubber processing chemicals	(i) Issuing 1500 test reports (ii) Providing 10 sampling services on customer request (iv) 15 trouble shooting activities (v) 6 Training Programmes
32	Quality improvement & quality assurance of latex, raw rubber and rubber processing chemicals	i) Introduction of One new test method/modification of existing methods to determine soap quantity in centrifuged latex. (ii)Introduction of one new chemical to reduce phenolic discolouration. (iii) Complete Ampara area (iv) Complete 5 new clones (v) 4 projects to be conducted
33	Development of novel recycling processes for latex /dry rubber based compound /product waste	Development of one reclaiming process for rubber waste
34	Development of novel recycling processes for latex /dry rubber based compound /product waste	Development of one reclaiming process for rubber waste
35	Development of rubber composites with waste materials for different applications	Development of one rubber composite with a waste material

36	Development of rubber composites with coconut husk materials for special applications	Manufacture of one rubber product with a coconut husk material for a special application.
37	Development of cellular rubber products with latex /dry rubber for special applications.	Manufacture of a cellular rubber product for a special application
38	Development of a nitrosamine safe accelerator system for sulfur vulcanization of dry rubber compounds	Establishment of property correlations for new systems No. of new systems
39	In-situ filler reinforced natural rubber latex	One novel method for preparation of reinforced natural rubber lattices
40	Introduction of new preservative system for NR field latex	Novel preservative system for natural rubber latex
Seed Certification Service		
1	Determination of suitable seed film coating technique	Overcome quality deterioration problems of local vegetable seeds over time
2	Development of seed vigour test protocol for selected Solanaceae crops	Vigour testing methods were identified for Solanaceae crops
3	Impact of climate change on quality of seed paddy and strategies practiced by farmers for climate change adaptation in Anuradhapura district	A program to mitigate effect of climate change on seed production were identified
4	Determination of most suitable pod range for the seed yield and quality of Okra	Enhancement of seed production technology of Okra
Sri Lanka Atomic Energy Board		
1	Improved Assessment of Initial Alarms from Radiation Detection Instruments	Enhance the Nuclear Security Detection Capabilities of the Country
2	Advancing Radiation Detection Equipment for Detecting Nuclear and Other Radioactive Material out of Regulatory Control	Enhance the Nuclear Security Detection Capabilities of the Country
3	Development of Giger-Muller Counter/ Had Held Survey Meter & Cloud Chamber	Knowledgeable society on Basic Radiation & nuclear technology
4	1.To contribute to clean drinking water supply for the communities with lack of accessibility to clean water in the dry zone of Sri Lanka (MalwathuOya and Lower Mahaweli	Identify and introduce clean groundwater sources for drinking purposes in MalwathuOya and Lower Mahaweli basins
5	2. Identification sources of nutrient pollutants in syrface water bodies: Field Work (Kelani river & lake Gregory	Identification sources of nutrient pollutants
Sri Lanka Institute of Nanotechnology (Pvt)Ltd		

1	Fabrication of VOC degrading devices for indoor and outdoor air purification	i. To synthesize high efficient and cheap VOC degrading photocatalysts. ii. To design and fabricate VOC sensing and degrading device iii. To design and synthesize a surface coating material (Paint or spray) to degrade VOC
2	Rapid Eco- friendly Solution for Organic Municipal Waste	1. To develop an effective and low- cost pre- treatment method to degrade organic waste 2. To isolate effective microorgan isms (bacteria, fungi and actinomycetes) and design a microbial community that capable of rapid degradatio n of BSW 3. To identify the effect of controlled temperatur e and aeration conditions on rapid degradatio n 4. To merge the above- identified chemical, biological and physical amendments to develop an accelerated procedure to convert the organic waste into a soil supplemen t.
3	Synthesis of large surface area graphite material by CVD method for the fabrication of anode in lithium ion battery.	Developme nt of negative graphite electrode (anode) which has capability of fast charging and discharging aiming to utilize in electric vehicle.
4	Development of a redox flow battery with enhanced electrochemicalperformanc e	i. A vanadium flow cell prototype having improved electrochemicalperformance and as a result improved reaction kinetics ii. Platform to experiment developed advanced carbon material on hi-tech application s like battery technologies and to develop expert knowledge iii. Initiation of establishin g a novel technology , RFB technology , in the country iv. Patents and/or publication s

			(i). Early detection of dengue fever within few minutes (ii). Identificati on of four different serotypes (iii). Identificati on of infection frequency, whether it is primary or secondary
5	Developme nt of onsite diagnostic method.		

	Tea Research Institute of Sri Lanka	
1	Development of tea cultivars for up country	
2	Screening lines for resistance/tolerance to the root lesion nematode (*P. loosi)* for UC regions	
3	Development of tea cultivars for mid country wet zone	
4	Screening lines for resistance/tolerance to the root lesion and burrowing nematodes for MC regions	
5	Screening of 5000 series tea cultivar for drought under MW (Long term)	
6	Development of tea cultivars for mid country semi-dry zone (Uva)	
7	Screening lines for resistance/tolerance to the root lesion and burrowing nematodes for Uva	
8	Screening of 5000 series tea cultivar for drought under Uva(Long term)	
9	Development of tea cultivars for low country	
10	Screening lines for resistance/tolerance to root lesion and burrowing nematodes for LC regions	
11	A 4.7 Screening of 5000 series tea cultivar for drought under LW(Long term)	
12	Development bi and poly clonal seed cultivars	
13	Development of a holistic approach in germplasm conservation, characterization and evaluation to enhance its rational utilization in tea breeding program	
14	Development (or screening) of tea cultivars specifically suitable for small growers who cannot afford to use high input or modern agricultural practices	

15	Use of *in vitro* techniques to supplement conventional breeding program	
16	Thrust Development of regional (AERs) and/or site-specific fertilizer/ dolomite recommendations	
17	Estimating crop response to macronutrients (N, K, Mg, S& P) at AER level.	
18	Development of methods for formulation of bio-organic and mineral or compound fertilizers suitable for tea	
19	Establishing dolomitic limestone requirements for better growth of mature plants in different tea growing regions at series level	
20	Development of economically viable slow releasing compound fertilizer basically for nitrogen, phosphorous, potassium and magnesium	
21	Introduction of micro nutrient fortified foliar formulation based on micro nutrient status in tea growing soils	
22	mineralization patterns of organic materials and bio avilability of nutrients to partially replace inorganic fertilizer for tea in Sri lanka	
23	the survey on possible factors of contamination of Rare Earth Ellements (REES) in made tea in Sri Lanka	
24	D/ SPND- Divisional activities (Long term)	
25	Studying root system and architectures with nutrient acquisition with root windows with a view to examine below and above ground relationships	
26	Evaluation of 2 new grasses, CO-3 and lemon grass in comparison with Mana&Gautemala	
27	Investigation on soil degradation by water erosion and conservation of tea lands in the low and mid elevations	
28	Evaluating growth performances and effects of identified shade tree species on tea and establishing cultural practices for them	
29	Development of pests and diseases management strategies for shade trees different AERs	
30	D/Agry-Miscellanoeus activities of the Division	

31	Carbon budgeting for different tea growing regions	
32	Climate change and its affect on pest incidences	
33	Use of Omic approaches towards the development of cultivars resistant to biotic and abiotic stresses	
34	Approaches to reduce deleterious effects of climate change on tea	
35	D/PHY Physiology Divisional Activities	
36	Evaluating micro irrigation systems for tea nurseries	
37	Environmentally Friendly Approaches for Weed Control in Tea Planta	
38	Screening biological control agents for reducing SHB damage in immature and mature tea	
39	D ENTO 1 Screening of new and alternate acaricides /insecticides /termiticides for strengthening IPM for tea pests	
40	Development of Nano pesticides for tea pest management	
41	Introducing user friendly alternative tea propagation and soil sterilizing techniques and protected tea nursery concepts to minimize contamination and prevent dissemination of tea nematodes through planting materials	
42	Evaluating methods for managing nematodes in young and mature tea	
43	Use of plant induced resistance for controlling blister blight	
44	Investigation of epidemiology of stem diseases of tea	
45	Development of a Multiplex PCR diagnostic kit to identify fungal pathogens in tea	
46	B140 Refinement critical points in tea manufacturing to minimize of microbial, contamination to meet food standards	
47	D/PlPa 1 activities Pathology Division (Long term)	

48	B116 Development of qPCR technique to screen tea for blister blight resistance(2017-2019)	
49	A 32.3 Evaluating and managing pest, disease and weed incidence under sustainable, organic and low input farming systems Evaluating biological and natural pest, disease and weed management methods	
50	A 48.7 Modifying tea chest packer to suit packling long leafy teas into Tea Kraft bags	
51	A 48.11 Development of a display instrument for pressure on withered leaves during rolling in orthodox roller	
52	B 124 Development of an instrument to detect optimum fermentation period	
53	A 48.14 Validation of process automation in fluid bed drying	
54	D TECH Diviaional Activities	
55	A25.3 Evaluating alternative energy sources for tea processing	
56	A25.6 Investigation on combined IR and Fluid bed drying in relation to quality and cost against normal fluid bed drying	
57	A 25.8 Efficient hot air supply system for Withering Trough	
58	B106. Factors influencing polyphenol content and studies on developing polyphenol enriched black tea (2016-2019)	
59	B107 Simple technique to identify adulterated black tea in the market (2014-2018)	
60	D/Bioch – Activities of the Biochemistry Division (Long term)	
61	A 41.1 Investigation on impact of agricultural policy reforms on tea production and export in Sri Lanka(2019-2022)	
62	D/Econ 2 Evaluation of research recommendations and micro-analyses for the tea (2018-2022)	
Veterinary Research Institute		
1	Establishment of metabolizable energy (ME) and organic matter digestibility(OMD) values	Establishment of ME and OMD values of LRF available in Central and Wayamba provinces

	of locally available ruminant feed stuffs in Central and Wayamba provinces	Publication of ME and OMD values of LRF among stakeholders including farmers, extension workers, nutritionists etc.
2	PCR based detection of cow milk adulteration in fresh goat milk in Kandy district	Determination of the percentages of cow milk adulterated in retail goat milk Determination of the sensitivity of PCR based technique over goat milk adulteration with cow milk
3	Occurrence of Ethanol unstable milk and its relation with physico-chemical characteristics of milk	To study the occurrence of ethanol unstable milk in different farming systems and its relation with physcio – chemical characteristics of milk.
4	Relationship among bacterial counts and somatic cell counts and factors influencing their variation in cow, buffalo and goat milk in four provinces	Determination of the relationship between SCC and bacterial counts in individual and bulk cow , buffalo and goat milk samples Determination of individual SCC count in association with age, breed, different parities and stage of location
5	Development of strip based methods for detection of common adulterants in milk	To develop the paper based dry reagent strips for detection of adulteration in milk To validate the working of developed strips in raw and processed milk
6	Evaluation of veterinary drug residues in animal products	To examine whether the current level of veterinary medicinal residues is at the European import thresholds in animal products of local origin
7	Examine the efficacy of selected probiotics and phytobiotics to replace antibiotics in poultry feed	Examine the effect of dietary natural gut health enhancers compared to dietary antibiotic growth performances on the production performances
8	Examine the nutritional quality of some non – conventional feed stuff which can be used in animal feed rations	i. To identify whether the non-conventional feed resources have nutritive value which can be used in animal feed. ii. To incorporate them in feed formulations depending the availability
9 10	Development of field screening test for antibiotic residues in milk	To develop field screening test for antibiotic residues in milk
11	Characterization of ESBL producing E.coil and fluoroquinolone resistant Salmonella species in commercial broilers.	Identification of ESBL producing E.coil and fluoroquinolone resistant Salmonella species in poultry Determination of phenotypic

		antimicrobial resistance in E.coil and Salmonella species in poultry Understand the epidemic clone of E.coil and Salmonella which found in poultry.
12	Detection and characterization of MRSA, ESBL and carbapenem resistant E. coil among isolates in bovine mastitis	Identification of MRSA, ESBL and Carbapenem resistant E. coli in clinical mastitis Understanding phenotypic antimicrobial resistance in S. aureus and E- coli which caused mastitis in cattle. Understand the epidemic clone which caused mastitis in cattle by MLST.
13	Study of the underutilized poultry production systems including duck, turkey, guinea fowl, Japanese quail and indigenous chicken in Sri Lanka	To identify and characterize the existing subsystems in the small holder underutilized poultry production systems Economic evaluation of different subsystems in the smallholder underutilized poultry production systems" To investigate the potentials and constrains in the existing small holder alternate poultry production systems to minimize the impediments to low input small holder underutilized poultry production systems
14	Screening of Imported dairy cattle for acute Fasciola hepatica (Ab) by Using ELISA and Confirmation of the Clinical Disease if present	Screening of imported dairy cattle for acute Fasciola hepatica (Ab) Using ELISA. Individual identification of dairy cattle with Fasciolosis caused by Fasciola hepatica using Anti-Fasciola hepatica capture ELISa
15	Study on use of Histopathological and Immunohistochemical techniques for detection of bovine tuberculosis	1. Establishment of immunohistochemical (IHC) technique for diagnosis of bovine tuberculosis at VRI 2. Comparison of detection rates of bovine TB through histopathology H&E staining, Ziehl - Neelsen technique and immunohistochemiistry
16	Immunohistopathological study on Porcine Reproductive and Respiratory Syndrome (PRRS) and porcine Parvo Virus (PPV) infection	1. Establishment of immunohistochemical technique as a confirmatory diagnostic tool of PRRS and PPV on formalin – fixed paraffin embedded tissues

		2. Field study on PPV and PRRS using the developed technique
17	Introduction of serological vaccine matching technique to assess ability of cross protection of locally produced FMD vaccine against field isolates	Estimating the level of cross- protection affords by locally produced FMD vaccine against field viruses
18	Improving locally produced FMD vaccine by 146S quantification and shelf life extension	FMD 146S Quantification by sucrose density gradient centrifugation and formulate FMD vaccine with induces protective antibody level Extend shelflife of FMD Vaccine Determine the dose and efficacy of FMD Vaccine in goats
19	Detection of infectious bronchitis using enzyme including hemagglutination assay.	To establish an enzyme induced hemaggutination assay protocol for identification of IBV in Sri Lanka
20	Molecular tools and geographical information system to develop specific control strategies for bovine mastitis	Characterize clusters of mastitis based on management system and causative organisms Appropriate treatment regimes and preventive measures
21	Molecular detection methods and diversity of M. bovis , for effective control strategies	To detect MTC from tissues and excretions of TB suspected animals. Diversity of Micobacteriumbovis or other MTC isolates To evaluate the possible interspecies transmission and public health importance
22	Genetic polymorphism in livestock to identify biological markers in different populations	Determine the polymorphism among selected populations of cattle and goats To detect specific markers associated with production , weather conditions, health, breeds or groups
23	Microbial molecular profiling to determine origin and transmission of bovine mastitis	To identify causative agents of bovine mastitis in highly affected farms in Uva and Central Provinces. Molecular characterization of the causative microorganisms and profiling them farm wise and animal wise
24	Establishment of fatty acid profiles of animal feeds and products	Establishment of analysis methods for gas chromatography detection of fatty acids Establishment of fatty acid profiles of commonly found animal feeds in country`

25	Identification of native wild life species in extinction as a technical assistance to prevent illegal slaughtering	To establish technology to identify two native animal species in extinction.
26	Layer performances and Egg Quality characteristics affecting the hatchability, in village chicken at CPRS, Karandagolla	Study the CPRS breeder layer performances and to identify the egg quality characteristics affect the hatchability
27	Introduction of oil adjuvant vaccine to control ND in Sri Lanka	Introduction of oil adjuvant vaccine to control layer chickens Detection of duration of immunity and potency of the vaccine
28	Preparation of poultry foundation stock 1 to Central Poultry Research Station (CPRS), Karandagolla	To introduce new genetic makeup to the CPRS for higher production performance with tropical adaptability and disease resistance

Annexure 04: New Products Developed

Arthur C. Clarke Institute for Modern Technologies	
1	Carbon fibremulticopter
2	Cube satellite (Research) Raavana-1
3	River water level gauge (IoT)
Centre for Defence Research and Development	
1	Ballistic Rubber
Coconut Research Institute	
1	Nano gel dispenser for red weevil pheromone
2	Red weevil repellent
Department of Export Agriculture	
1	Cinnamon soup cube
2	Cinnamon ice cream
3	Cinnamon sugar free biscuit
4	Cinnamon mosquito repellent oil
5	Cinnamon ,Citronella balm
6	Cinnamon ,Citronella coil
Farm Mechanization Research Centre	
1	Mushroom substrate bag filling machine
Field Crops Research and Development Institute	
1	Three drought tolerant high yielding maize hybrids varieties were released
2	Two high yielding Groundnut varieties were released
Fruit Research and Development Institute	

1	Development of two types of Jackfruit based vegetarian fingers enriched with mung been and Okara

Gem and Jewellery Research and Training Institute

1	Orthopedic Mattress with therapeutic Properties, made of tourmaline and mica embedded Foam Rubber
2	Tourmaline infused cotton fabric produced via a screen printing process

Industrial Technology Institute

1	Horse gram based porridge
2	Horse gram based instant drink powder
3	Horse gram nutritious bar
4	Horse gram RTS drink
5	Horse gram all-purpose flour
6	Pumpkin soup mix
7	Perfume for woman (Ceylon essential oil as ingredients)
8	Cinnamon carbonated drink
9	Home composter to compost biodegradable food waste within a day
10	Natural Agricultural Pest Control Agents

National Building Research Organisation

1	Paving block (only as a pilot work)

National Engineering Research & Development Centre

1	Industrial coconut de-husking machine
2	Device for measuring moisture content of tea leaves
3	Ayuvedic juice extractor, gully making machine , paste making machine
4	Tablet making machine for ayurvedic industry
5	Paste making machine for ayurvedic industry
6	Security robot with autonomous movement
7	Automated hopper machine

Palmyrah Research Institute

1	Formulation of facial cream
2	Formulation of tuber flour noodles

Rice Research and Development Institute

1	Rice variety Bw312 Rice variety Bg409

Sri Lanka Atomic Energy Board

1	IAEA Trace Mobile App for identification the real Alarm cargo containers
2	1. Radi-Count Giger-Muller Counter 2. Radi-Rate survey Electronic cooling 3. Cloud Chamber meter

Sri Lanka Institute of Nanotechnology (Pvt)Ltd

1	Seed pod

Sugarcane Research Institute

1	Completion of preliminary development of Organo-mineral fertilizer pellets using compost made out of the sugarcane industry by-products and synthetic mineral fertilizers.
2	Designing a hot-water treatment plant (HWTP) with the capacity of 01 tonne/hour for Ethimale plantations (Pvt) Ltd.
3	Installing cold-water pumping system and new electrical panel board for hot-water system renovation of HWTP at SRI, UdaWalawe.
4	Producing 4,871 kg of jaggery
5	Producing different shape of jaggery ,different flavouredjaggery ,sugarcane juice beverage and sugarcane syrup for exhibition purpose

Annexure 05: New Processes

Centre for Defence Research and Development	
1	M/S Pot company to mass production of ballistic rubber developed by CDRD
Coconut Research Institute	
1	Protocol for analysis of volatile organic compounds from coconut fruits
2	Protocol for analysis of phenolic compounds from coconut fruits
3	Protocol for analysis of waxes from coconut fruits
Field Crops Research and Development Institute	
1	Bio control agent suitable for controlling onion flower black mold and onion bulb black mold was identified
2	A non-chemical management method for virus diseases in chili. using polythene mulching was identified
3	An integrated pest management package was developed for the control of Fall Army Worm (FAW) in maize.
Gem and Jewellery Research and Training Institute	
1	Value addition of gem minerals
Industrial Technology Institute	
1	Minimally processed banana blossom
2	Minimally processed cooking banana
3	Minimally processed cooking banana peel
4	Minimally processed young jak
5	Natural fragrance mixture originated from Sri Lankan essential oils (Body spray & Perfume)
6	Thermal process validation of canned food and low moisture processed food operations
7	Method development for noise dose testing
8	Anti-inflammatory gel formulation using a bioactive plant extract
National Building Research Organization	

1	Casting of green masonry product using textile waste
National Engineering Research & Development Centre	
1	Application of fly ash in construction industry
2	Rapid compost making process
Natural Resources Management Centre	
1	Issuring of weather advisories to farmers to minimize risk of crop failure.
	Sugarcane Research Institute
1	Developing an in-vitro culture protocol for elimination of sugarcane White Leaf Disease (WLD) from infected sugarcane.
2	Optimization of a q PCR program to quantify the available amount of WLD Phytoplasma in sugarcane.
Tea Research Institute of Sri Lanka	
1	Validation of process automation in fluid bed drying
2	Development of an efficient hot air supply system through radiating steam and hot water circulation

Annexure 06: New Technology Developed

Coconut Research Institute	
1	Coconut butter making technology (2019)
2	Natadecoco making technology (2019)
Field Crops Research and Development Institute	
1	Sprinkler irrigation based agronomic management packages capable of giving higher yields for chili, onion and mung bean
2	Drip irrigation based agronomic management packages capable of giving higher yields for chili and onion
3	Desiccating and defoliating the mung bean crop for mechanical harvesting
4	Preparation of rice husk biochar with modified „Kunthaniya"
5	Preparation of corn cob biochar with Double Barrel Technique (DBT)
Fruit Research and Development Institute	
1	New in-situ grafting technology for citrus
Industrial Technology Institute	
1	Adulteration detection of ghee

2	Bee honey test kit for adulteration detection of bee honey
National Building Research Organization	
1	Polyester spandex embedded masonry product with shock absorption and water infiltration features
National Engineering Research & Development Centre	
1	Implementation of fuelwood feeding system for tea industry
2	Advancement of NERDC crematorium

❖ **Approval Process of the Report by the Commission:**

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