SCIENCE AND TECHNOLOGY
STATUS REPORT OF SRI LANKA - 2018

National Science and Technology Commission
Ministry of Science, Technology & Research

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SCIENCE AND TECHNOLOGY STATUS REPORT OF SRI LANKA - 2018

(Prepared based on the data collected from 39 Public Sector S&T Institutions)

National Science and Technology Commission

(Ministry of Science, Technology and Research)

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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 Technology. One of the key functions of the Commission is to prepare and submit a report annually, to the government, reviewing the Science and Technology (S&T) activities of the country in the preceding year. In this regard, a survey was conducted to collect relevant data from the public Sector S & T institutions to review the S & T activities taken place during the year 2018. This report was prepared based on the data gathered from 39 public sector S & T institutions who responded to the survey. The report reflects the performance of those public sector institutions under the subcategories 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 collected under this survey will be a good knowledge source that would help to collectively measure the current S&T capacity of those institutions. It will also assist in identifying gaps in respective sectors. The recommendations proposed in this report can be used for improvements of relevant institutes by adopting appropriate interventions including policies, R & D interventions, capacity development etc.

This report is considered a unique document that provides a clear vision of the scientific landscape of the public Sector S & T institutions. We are convinced that the analysis of this report will assist in providing appropriate directions towards improving performance while supporting the knowledge creation that is required for decision-makings the public sector S & T institutions.

I take this opportunity to congratulate the staff of the NASTEC for their hard work towards successfully completing the S&T status report for the year 2018 and would like to extend gratitude to the Chairmen, Directors and CEOs of the Public S&T institutions who provided the required data and information in completing this report.

Nazeema Ahamed
Actg. Director/CEO
NASTEC

28th April 2021

PREFACE

The National Science and Technology Commission (NASTEC) was established by the Science and Technology Development Act No. 11 of 1994 and came into operation in August 1998. It became a functional Commission in January 1999. NASTEC, by its mandate, is the apex policy-formulating and advisory body on Science and Technology (S & T) matters to the Government of Sri Lanka. NASTEC comply to submit a report annually to the Government, reviewing the S & T activities in Sri Lanka in the preceding year, with the objects set out in Section 2 of the Act and 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[1]. Within this context, the NASTEC reviewed the status of 39 public-sector S & T institutions through a survey for the year 2018.

Information was collected across five broad areas from the institutions: i) Human resources, ii) Physical resources, iii) Research inputs, iv) Research outputs, and v) Institute services and data were analysed 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/Director Generals/Directors of the institutions that participated in the survey by giving institutional data and the liaison officers of each institute for their support in data gathering, which allowed us to compile this report. We appreciate the valuable advice and direction provided by the Commission-appointed subcommittee, the Acting Director, and the NASTEC personnel in preparing this publication.

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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

BMARI – Bandaranayake Memorial Ayurvedic Research Institute

CEA – Central Environmental Authority

CoSL-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 Jewellery 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

OECD – Organization for Economic Co-operation and Development

PGRC – Plant Genetic Resource Centre

PPP – Public Private Partnerships

PPS – Plant Protection Service

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 & 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

SLCARP – Sri Lanka Council for Agricultural Research Policy

SRI – Sugarcane Research Institute

TOT – Transfer of Technology

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 National Science and Technology (S&T) Status Report of 2018 has been prepared based on the data collected from 39 public sector S&T institutions in Sri Lanka. The data presented in the report is organized per the international guidelines on reporting S & T[2]. The report aims to assess the activities of public sector institutions in accordance with the NASTEC mandate.

Based on the survey, as far as human resources are concerned, more than 95% of the public sector employees were working on a permanent basis, with an equal ratio of scientific to non-scientific cadre positions. One-third of the scientific cadre are researchers, with women accounting for 52% of them. It demonstrates that remarkable gender equality has been preserved across the disciplines in the public sector, and it is higher than the norm for the globe, accounting for 46%[3]. However, the results show that female representation in engineering and technology was low, accounting for only 37%. It could be a result of the long-term trend of gender disparity reported in the discipline's annual graduate outputs. A framework must be in place to increase female representation in it because it was 29% in Globe compared to 28% in Sri Lanka during the reporting period. Additionally, Sri Lanka has a lower researcher-to-population ratio than the SAARC region, at 103.4 researchers per million people[4,5].

Most of the researchers were experts in the fields of agriculture and veterinary sciences, followed by natural sciences, engineering, and technology. The average number of researchers working at a research institute was 35, with a consistent pattern over the decade, and most of them were in their mid-career stage. Only 16% of researchers hold a PhD. Most of the institutions had vacancies for scientific cadres, but the hiring process was incomplete for various reasons, most notably administrative issues. The survey estimated the employee turnover rate for researchers was between 5% and 7%. It is lower than the global estimate of 10.9% for the same period. However, according to another finding, nearly half of Sri Lankan expatriates have a PhD[6]. It stresses the need to address the core issues related to brain drain and, in particular, to cope with it at the higher end. Concerning the capacity development of the scientific cadre positions, 80 funded postgraduate degrees were offered by the institutions,

[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] World bank Blog ; https://blogs.worldbank.org/governance/five-facts-gender-equity-public-sector
[4] World bank data 2000- 2017 ; https://data.worldbank.org/indicator/SP.POP.SCIE.RD.P6?locations=LK
[5] NSF Statistical Handbook 2018; http://www.nsf.ac.lk/index.php/pdf-stprd-stat-handbook-2018
[6] UESCO Science Report 2021; https://www.unesco.org/reports/science/2021/en/south-asia

with nearly half of them being for PhDs. As a whole, the scientific staff attended 699 training workshops and conference proceedings, of which half of them were international programs. The lack of a proper system to assess the impact of them on a long-term basis is concerning.

The institutions surveyed were equipped with 315 research laboratories, 37 workshops, 42 libraries, and 91 auditoriums under common infrastructure facilities. In addition, some of the institutions owned specific facilities, such as mobile labs, research incubators, pilot plants, engineering and plant museums, plant nurseries, and technological parks. All the institutes had basic ICT facilities and internet access. Twenty-six of them had a dedicated database to support their R & D-related services. The entire research staff was provided with adequate ICT facilities so that they would be supported to adapt to a national e-governance system, which has been one of the long-term national desires.

The National S&T Policy (2009) and the National Research and Development Framework (NRDF: 2016-2020), the two-cabinet approved S&T-related national policy and strategic framework developed by the NASTEC in collaboration with the subject Ministry of Science and Technology[7,8],were used to integrate most of the institution's R & D-related activities. The NRDF-based initiatives are mainly focused on the areas of food, nutrition, and agriculture. Meanwhile, most of the projects also contributed to achieving the targets set out for the UN SDGs on good health and well-being, followed by industry, innovation, and infrastructure.

The Government of Sri Lanka (GoSL), as usual, provided the majority of the funding for these institutions. Infrastructure development received the bulk of spending, followed by research and development. Total funding for R & D activities came to LKR 2072 million, with the agricultural and veterinary sciences sectors contributing the most. The fund utilisation rate (FUR) of institutions was often higher than 94%. According to estimates, income per institution increased by 32% from the previous year. However, the investment in R&D-to-GDP ratio of 0.13% is lower than the regional major countries as a whole, according to data from the World Bank[9].

In 2018, 952 research projects were conducted, with an annual completion rate (ACR) of 23%, and 75% of them were in agriculture and veterinary sciences. There were also 49 products, 24 processes, and 46 technologies generated, and 1,553 scholarly works published in various

[7] National Science and Technology Policy (2008); http://www.nastec.gov.lk/files/national_science__technology_policy_of_sri_lanka_english.pdf
[8] National Research and Development Framework (2016), http://www.nastec.gov.lk/reports/nrdf
[9] The world bank data; https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?locations=LK

scientific outlets, with nearly half of them being abstracts. Only 13% of the papers were published in SCI/SCI extended journals. It reflects the standard index of scholarly publications per unit GDP, which was 17.9 for Sri Lanka in the reporting period, which is lower compared to the SAARC region (51.9) and the globe (33.6) norms. The establishment of a national framework for research excellence, particularly concerning financial incentives, can improve the situation. However, in contrast, the average publication-to-GERD ratio has a value of 6.8, which is higher than the world and regional norms for it.

In total, the researchers received 64 honours, including 6 international honoraria, and 19 patents were also granted, one of which was international. Forty-five products and eighteen processes were aimed at the initial consumer groups over the time period as part of the market acceptance process. Sixty-four technologies were transferred and thirty-four recommendations were also adopted.

While recruiting researchers to the institution, gender equity should be encouraged, and a framework should be in place for the brain gain of PhD-based researchers. A mechanism should be in place to cope with the administrative issues and speed up cadre recruitment procedures. Existing state procurement procedures must be simplified within a robust framework to eliminate the bottlenecks in the chain. Further, a systematic assessment should be in place to assess the outcomes of the training being taken by the employees. The research projects that fulfil the country's SDG 2030 goals and targets must be supported through national policies and plans. A mechanism must be in place to ensure the completion of projects within a stipulated time frame. All scholarly work should be encouraged to get published through open-access peer-reviewed scientific outlets to assure the quality and transparency of the project's value chain. A robust central platform needs to host all the institutional R & D databases within an IP framework. The proposed system could streamline information flow within and across the sectors while eliminating duplicity in the existing system[10,11] .

[10] Shahmy, Seyed , Science Technology Innovation Data Mechanism: from Creation to Management to Application in Sri Lanka, 2019. 10.13140/RG.2.2.36490.00969.
[11] Shahmy, Seyed & Perera, Welgamage & Munagamage, Thilini & Fernando, Sirimali. (2021). New horizon for data-driven Science for Policy -A proposed system to generate robust scientific evidence; [https://www.researchgate.net/publication/361791859_New_horizon_for_data-driven_Science_for_Policy_-A_proposed_system_to_generate_robust_scientific_evidence]

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) affairs for the Government of Sri Lanka. The Commission is mandated by the Act to produce an annual report to the government, assessing the country's scientific and technological status in the year before 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[12]. The report intends to provide stakeholders with information in compliance with the mandate.

A national research and innovation system is made up of a set of institutions in a country, such as government institutions, public sector research organizations, 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[13]. 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[14]. As a result, S&T institution performance has a substantial impact on the overall efficiency of the national research and innovation ecosystem, making it vital to evaluate them.

To accomplish the task, two attributes were considered by NASTEC. The first, on the activities of major S&T institutions in Sri Lanka, was gathered through a questionnaire-based sample survey, and the rest, on related information, was gathered from annual publications of leading global and local learned societies and bodies, such as the World Bank, UNESCO, World Intellectual Property Office (WIPO), University Grant Commission (UGC), and the Central Bank of Sri Lanka (CBSL).

The survey was conducted using the following methodology: A questionnaire was designed to collect data for the year 2018, and it was emailed and mailed to 41 public sector S&T institutes.

[12] Science And Technology Development Act (No. 11 of 1994); http://www.commonlii.org/lk/legis/num_act/satda11o1994368/s5.html
[13] National Innovation system, OECD; https://www.oecd.org/science/inno/2101733.pdf
[14] Mormina, M. Science, Technology and Innovation as Social Goods for Development: Rethinking Research Capacity Building from Sen's Capabilities Approach. Sci Eng Ethics 25, 671–692 (2019). https://doi.org/10.1007/s11948-018-0037-1

Human resources, physical resources, research planning, research inputs (money), research outputs, and services were all covered in the survey (for industries, S&T institutions, and the general public). At the request of NASTEC, liaison officers were appointed by the institutions to complete the questionnaire and obtain a prompt response from the institutions. The questionnaire was given a four-month deadline to complete, and by the conclusion of that time, 39 institutions had responded to the request, with two institutions, the Fruit Research Development Institute (FRDI) and Sri Lanka Atomic Energy Authority (SLAEA), failing to do so.

The data collected was analysed and compiled into a report using a detailed descriptive and comparative approach to reflect the public sector's contribution to S & T during the period. For the analysis, the institutions surveyed were categorized into 5 disciplines based on OECD Fields of Research and Development (FORD): Natural Sciences (i), Engineering and Technology (ii), Medical and Health Sciences (iii), Agricultural and Veterinary Sciences (iv), and Social Sciences (v); (Annexure 01). The sectorial representation of the number of institutions surveyed is given in Table I.

The findings were presented in the report in six major sections: Human Resources, Physical Resources, Research Planning, Research Funding, Research Outputs, and Institutional Services. Each section begins with a detailed description with an appropriate graphical presentation to reflect the status in the reporting year, with respective trends over the period from 2012 to 2018. The run charts were extrapolated by calculating the average figure distributed per institute since the number of institutes included in the survey for 2012-2018 varied. Some of the results of the assessment cannot be authenticated with global and regional figure-indices of the reporting year because only a few sets of such indices were available when the report was written. However, the report corroborates these limited claims wherever applicable. The recommendations and conclusions derived from the survey could be used as a reference to enhance the performance of the institutions.

Although NASTEC is responsible for preparing the yearly S & T status report nationally, the work has various constraints. The standing of private-sector institutions and the coverage of the higher education sector are not covered in this report. Similarly, while the purpose of the work is to nationally assess the status of S&T as aforementioned, only a subset of 39 institutes' surveyed data was included, which mostly functions on R&D-related activities that are part of the S&T ecosystem as a whole. In contrast, in Sri Lanka, there are few private-sector

institutions with specialized R & D facilities among the institutions surveyed. Thus, the generalization of this report's findings to reflect the National status of S & T might be inappropriate. However, the public sector institutions surveyed in the report are major players in the sectors and have an impact to a great extent on the national S&T ecosystems of the country. Hence, the report could assist in policy decisions on policy directives, strategic interventions, human resource needs, research planning, and funding priorities for the institutes.

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

Sector	Number of Institutes
Natural Sciences	6 (15%)
Engineering & Technology	6 (15%)
Medical & Health Sciences	2 (5%)
Agricultural & Veterinary Sciences	21 (54%)
Social Sciences	4 (10%)
Total	39 (100%)

From the 39 S&T institutes surveyed, the highest number of institutions were included in the sector of Agricultural & Veterinary Sciences (n = 21). A list of institutions belonging to each sector is given in Table II.

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 Meteorology (DOM)	Farm Mechanization Research Centre (FMRC)	Medical Research Institute (MRI)	Department of Export Agriculture (DEA)	National Science Foundation (NSF)
Gem & Jewellery Research and Training Institute (GJRTI)	Industrial Technology Institute (ITI)		Field Crops Research & Development Institute (FCRDI)	Sri Lanka Accreditation Board for Conformity Assessment (SLAB)
Geological Survey and Mines Bureau (GSMB)	National Building Research Organization (NBRO)		Forest Department (FD)	Sri Lanka Standards Institute (SLSI)
National Institute of Fundamental studies (NIFS)	National Engineering Research & Development Centre (NERDC)		Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI)	

Natural Resources Management Centre (NRMC)	Sri Lanka Institute of Nanotechnology (SLINTEC)		Horticultural Crop Research & Development Institute (HORDI)	
			National Aquatic Resources Research & Development Agency (NARA)	
			National Institute of Post-Harvest Management (NIPM)	
			National Plant Quarantine Services (NPQS)	
			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 & Plant Protection Centre (SCPPC)	
			Seed Certification Services (SCS)	
			Sri Lanka Council for Agricultural Research Policy (SLCARP)	
			Sugarcane Research Institute (SRI)	
			Tea Research Institute (TRI)	
			Veterinary Research Institute (VRI)	

Statutory Functions of the institutes:

The statutory functions of the institutes related to science and technology are categorized into six main sections.

1. R & D (Research and Development)
2. Research funding
3. S&T Services
4. S&T Policy Development
5. Technology Transfer
6. Science popularization

Figure 1.1 depicts the sectorial distribution of S&T institutions performing statutory functions.

The number of institutions carrying out the functions is indicated in Table III, and the sector-wise distribution of S&T institutions carrying out statutory functions is shown in Figure 1.1.

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

Statutory Function	**Number of Institutions**
R&D	31 (79%)
Research funding	4 (10%)
S&T Services	27 (69%)
S&T Policy formulation	10 (26%)
Technology Transfer	24 (62%)
Science popularization	13 (33%)

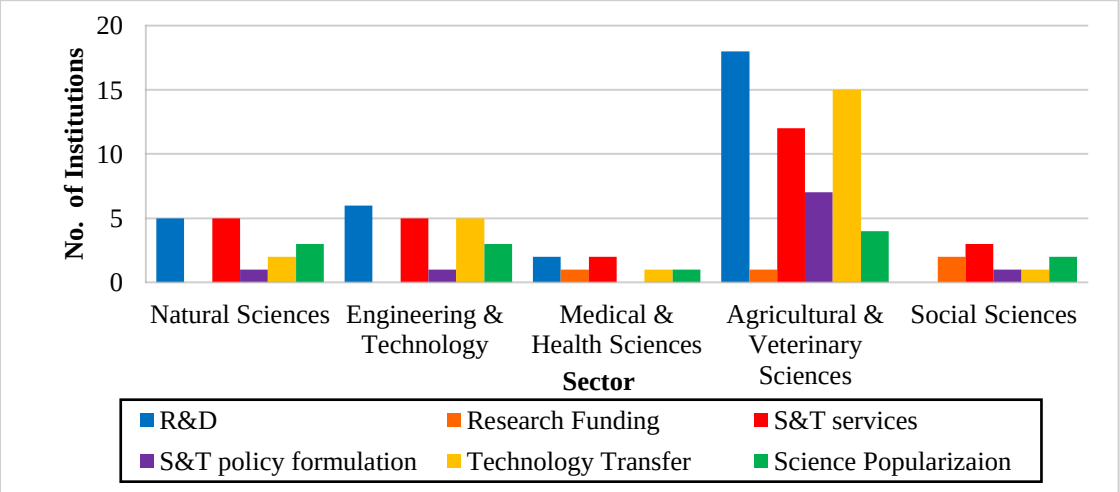


Figure 1.1: Sector-wise distribution of S&T institutions carrying out statutory functions

As per the OECD Frascati manual, 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. Seventy-nine per cent of institutions surveyed mandated R & D as one of the main statutory functions.

Research funding includes providing financial grants for R & D activities, which include basic research, applied research, and prototype development. Accordingly, four institutes (10%) carry out research funding, namely NRC, NSF, SLCARP, and MRI.

Analytical testing, quality assurance, laboratory accreditation, instrument calibration, personnel training, and any other specialized S&T-related services provided by the institution are considered as one of S&T services. Of the 39 institutes surveyed, 27 (69%) carried out at least one of the aforementioned S & T services.

In an era of rapid technological change, responsible policy-making institutes need to identify and prepare policies for new science, technology, and innovative developments[15,16]. Twenty-six percent of the institutes surveyed were involved in S & T policy formulation activities.

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[17]. Within the surveyed period, twenty-four (62%) institutes participated in technology transfer.

Science popularization 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. Of the institutes surveyed, 13 institutes (33%) take part in science popularization activities as mandated.

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

1. HUMAN RESOURCES

Human resources 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[18].

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[19]. 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 2.1). 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.

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.

[18] The Effect of Human Resource Development on Organizational productivity: (2013) http://dx.doi.org/10.6007/IJARBSS/v3-i10/295

[19] 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

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 2018, a total number of 8364 employees were working in the institutes surveyed, with 7990 (96%) being permanent, while 374 (4%) were on a contract basis.

The lowest number of employees reported as 17 working for PRI and NRC, while the highest number of employees reported as 938 who have attached to CEA. Of the total, scientific staff accounted for 50.4%, n=4218. Figure 2.1 depicts the distribution of scientific and non-scientific personnel par sector.

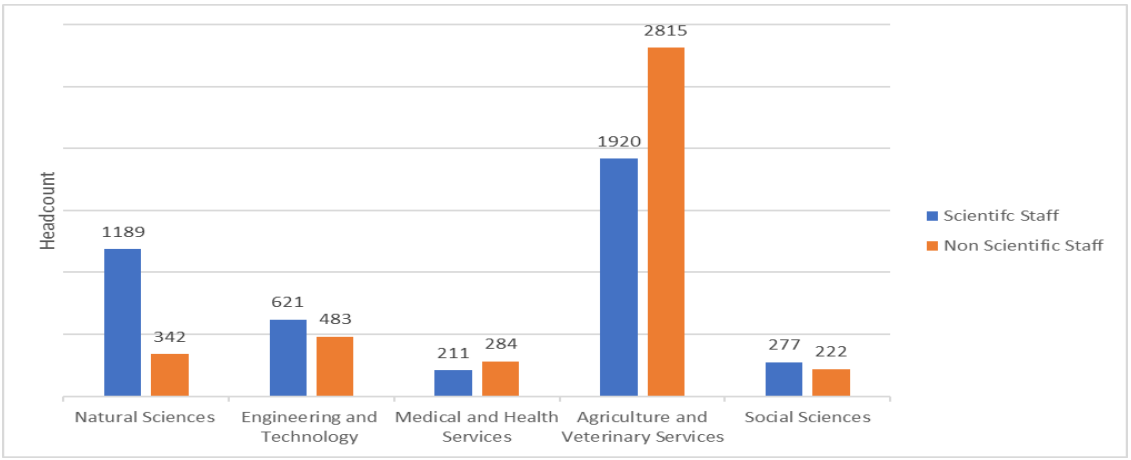


Figure 1.2: Sectoral breakdown of scientific and non-scientific staff.

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

Figure 1.2 gives the distribution of staff employed in each sector for scientific versus non-scientific categories. Non-scientific staff outnumbered scientific staff in the Agricultural and Veterinary Sciences and Health-Medical sectors, 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 predicted range. However, they were unable to be authenticated because there were no such global estimates 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		
Natural Sciences	156	1028	5	7	32	8	219	76	1531
Engineering & Technology	366	245	10	18	42	48	182	193	1104
Medical & Health Sciences	58	152	1	1	11	2	13	257	495
Agricultural & Veterinary Sciences	561	1334	25	14	122	75	654	1950	4735
Social Sciences	189	80	8	4	30	9	162	17	499
Subtotal	1330	2839	49	44	237	142	1230	2493	**8364**
Total	4218			281		1372			

Figure 1.3 shows the distribution of the numbers of researchers in the institutions. The lowest number of researchers were working in the SCPPC (n = 3), and the highest number was 150 attached to NBRO.

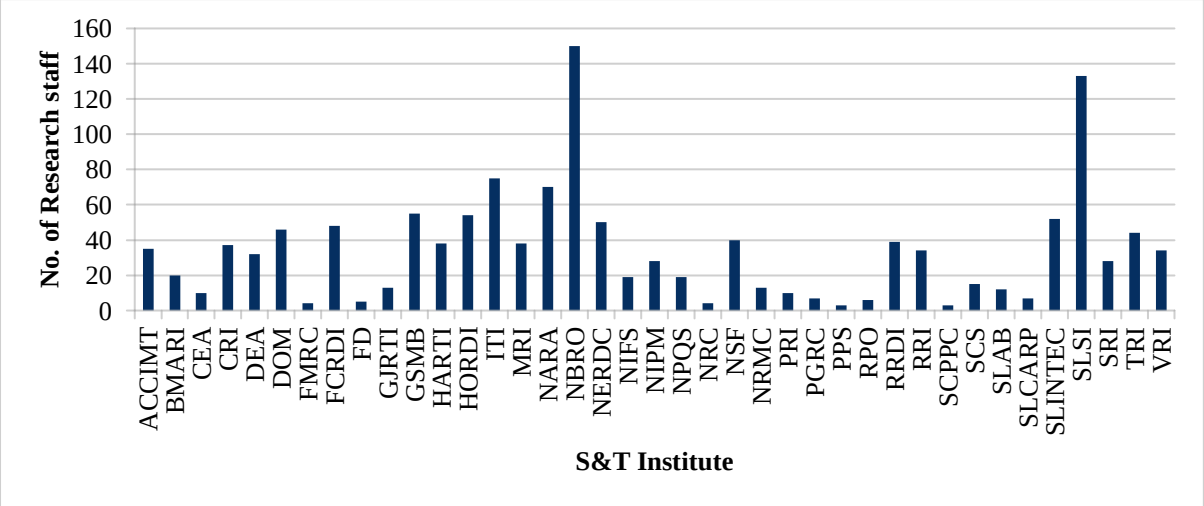


Figure 1.3: Depicts the distribution of research personnel among S&T institutions.

The average number of researchers working per institute was 35, and 10 out of 39 S&T institutions (26%) have researchers of less than 11. Figure 1.3 depicts the spectrum of research staff attached to the institutes. There were six institutes (16%) that employed more than 51 researchers. Table 1.2 provides a list of the institutions according to the number of researchers present

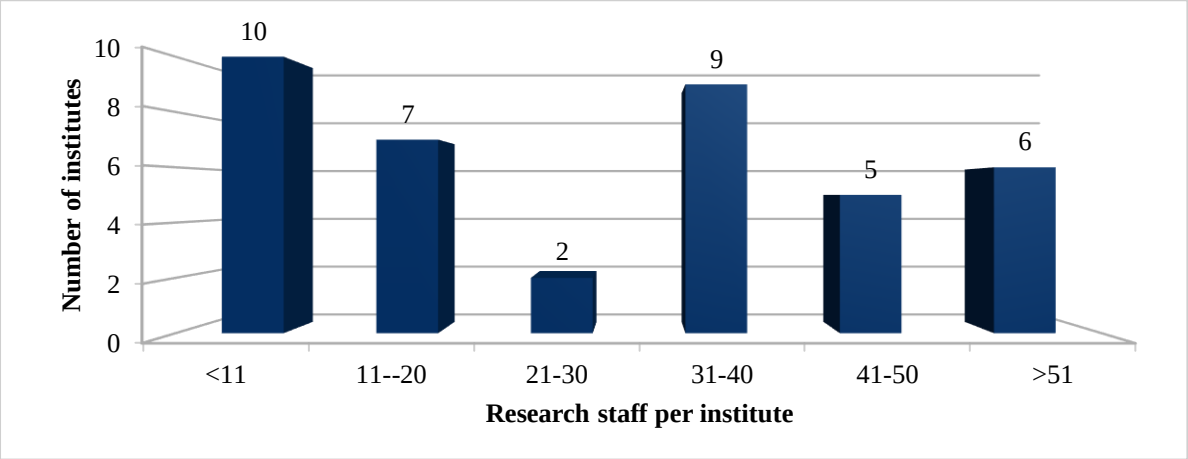


Figure 1.4: The number of research staff working per institute

Figure 1.5 shows the trend of researchers working per institute over the period 2012–2018. Generally, there is a slightly declining trend over the period specified.

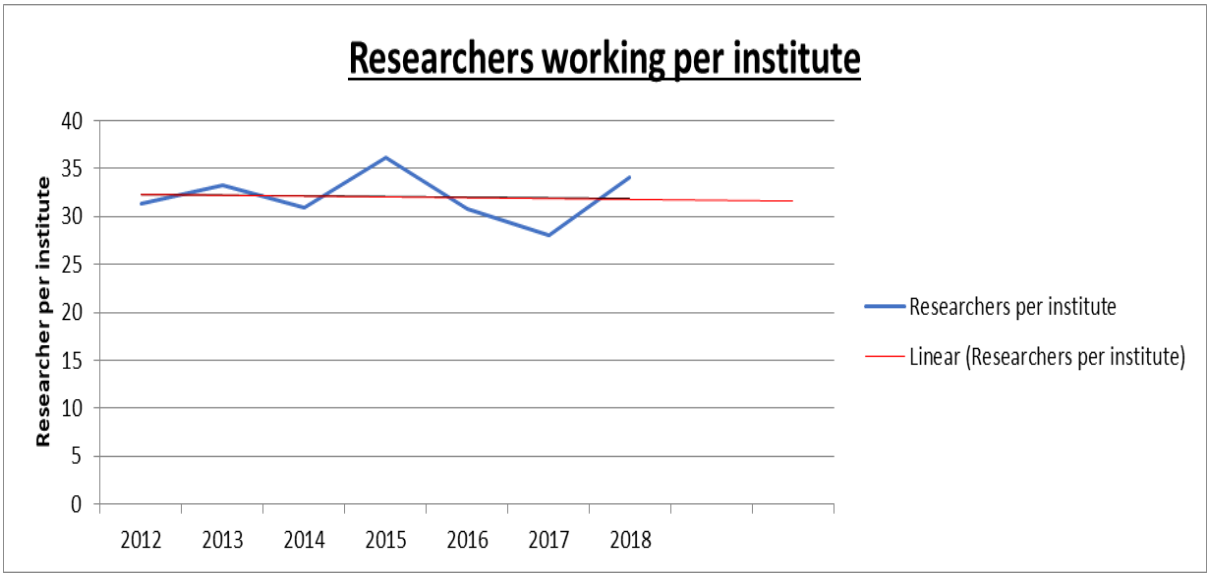


Figure 1.5: The number of researchers employed by each institute.

The scenario is the opposite when looking at national level norms via UNESCO statistics at a different matrix, such as researchers in R&D per million population. There was an upward trend over the period 2008–2012, although there was a decline of 103.47 in the reporting year of 2018 (Figure 1.6), which was also lower than the regional average.

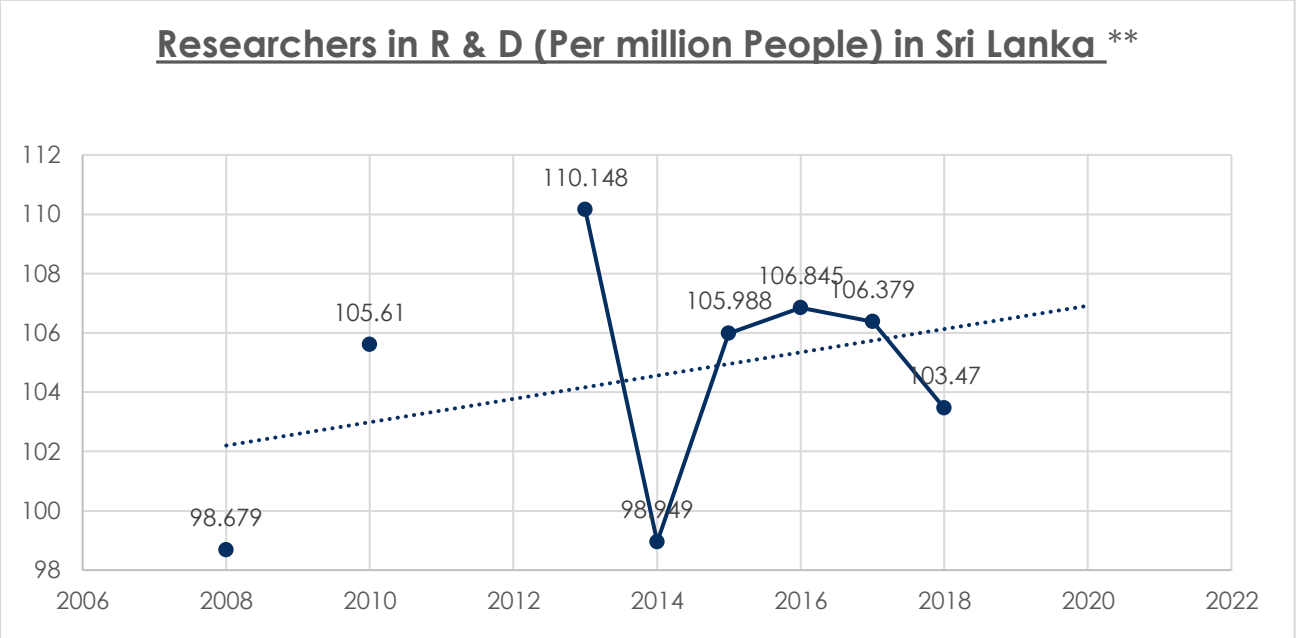


*Figure 1.6: Researchers per million Population (** Source: UNESCO Institute for Statistics - 2008-2017[20] ; 2018[21])*

1.2.Gender parity in Research staff (Researchers)

When considering the whole researchers (n =1330) of the institutes surveyed, 52% were females (n = 693) while 48% were males (n = 637), as shown in Figure 1.7. It reflects that gender parity for researchers has been achieved across the institutions, although it is slightly in favor of women. The sample survey further revealed that, in 2018, the representation of women researchers in Sri Lanka was 52%, higher than the global estimation of 33% [22].

[20] UNESCO Institute for Statistics -World bank
[21] http://www.nsf.ac.lk/index.php/pdf-stprd-stat-handbook-2018
[22] https://www.unesco.org/reports/science/2021/en

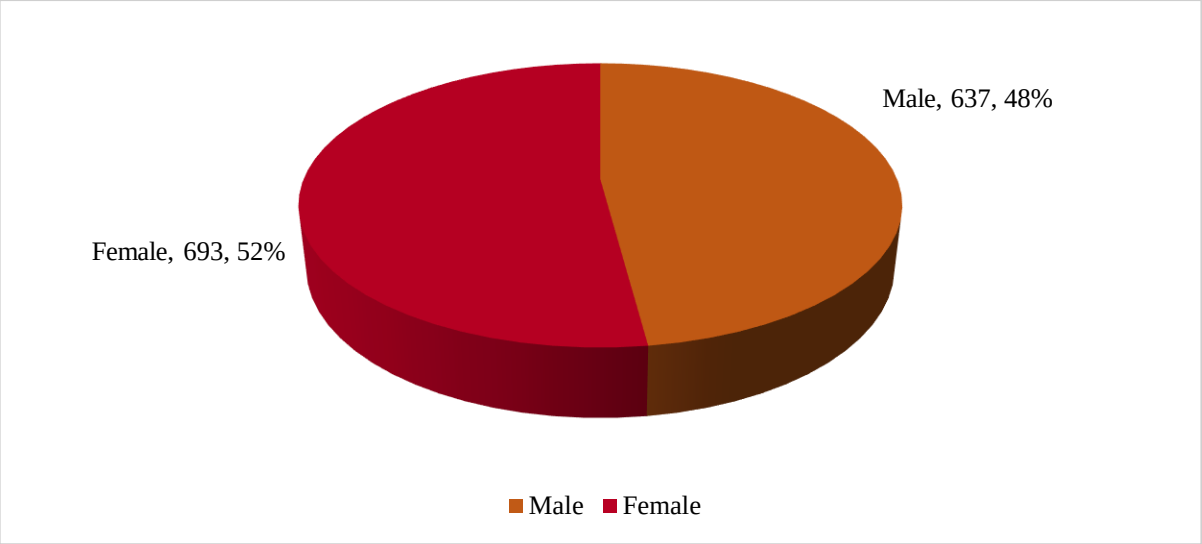


Figure 1.7: Gender distribution of research staff.

In Global index it was estimated that in 2018, 33% of the researchers are women[23].

1.3.Gender distribution of research staff by sector

From the sectorial perspective, female researchers were more prevalent in the Agricultural & Veterinary Sciences, Social Sciences, and Medical & Health Sciences. But the trend was in the reverse direction in the other two sectors, Natural Sciences and Engineering & Technology, where more female representation needs to be encouraged (Figure 1.8).

[23] https://www.unesco.org/reports/science/2021/en

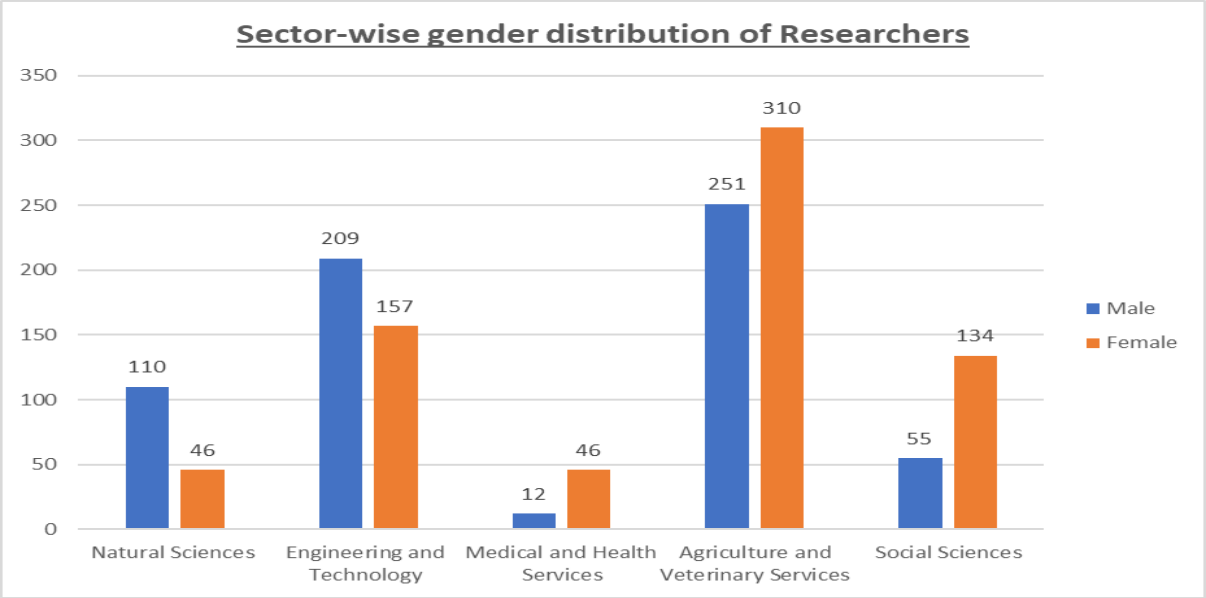


Figure 1.8: The gender distribution of research staff in different sectors.

1.4.Areas of expertise of the Research staff (Researchers)

According to the OECD guidelines, the survey classified the fields of specialization of the researchers as Natural Sciences, Engineering & Technology, Medical & Health Sciences, Agricultural & Veterinary Sciences, and Social Sciences. Across the sectors, most of the researchers were specialized in the field of Agricultural Sciences (n = 503, 37.8%), while Medical and Health Sciences was the least (n = 41, 3.1%) (Table 2.3).

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

Field of Expertise	Male	Female	Total
Natural Sciences	222 (46.9%)	251 (53.1%)	**473 (35.6%)**
Engineering & Technology	146 (62.7%)	87 (37.3%)	**233 (17.5%)**
Medical & Health Sciences	9 (22.0%)	32 (78.0%)	**41 (3.1%)**
Agricultural & Veterinary Sciences	223 (44.3%)	280 (55.7%)	**503 (37.8%)**
Social Sciences	36 (48.6%)	38 (51.4%)	**74 (5.6%)**
Other	1 (16.7%)	5 (83.3%)	**6 (0.5%)**
Total	**637 (48%)**	**693 (52%)**	**1330**

In 2018, 28% of the engineering graduates around the globe were women, and in Sri Lanka, the trend was the same, at 29%[24,25] (UNESCO Science Report 2021; Sri Lanka University Statistics 2018-UGC).

1.5. Sectorial composition of the research staff based on the highest academic qualifications held by them.

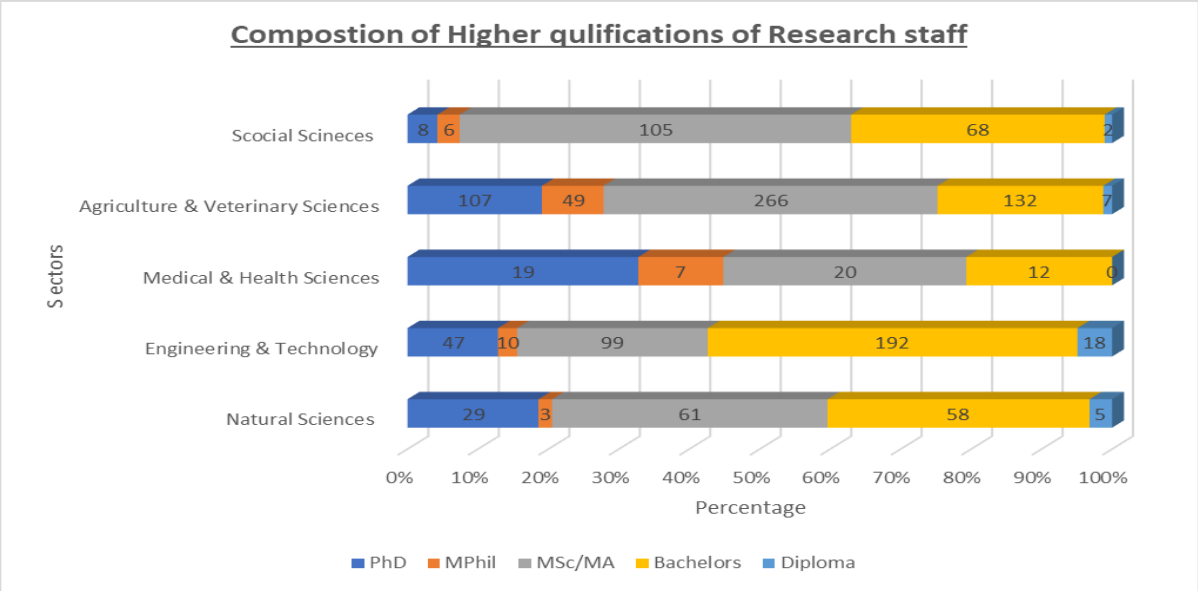


Figure 1.9: Composition of research the staff based on the highest qualifications held by them (Sectorial Distribution)

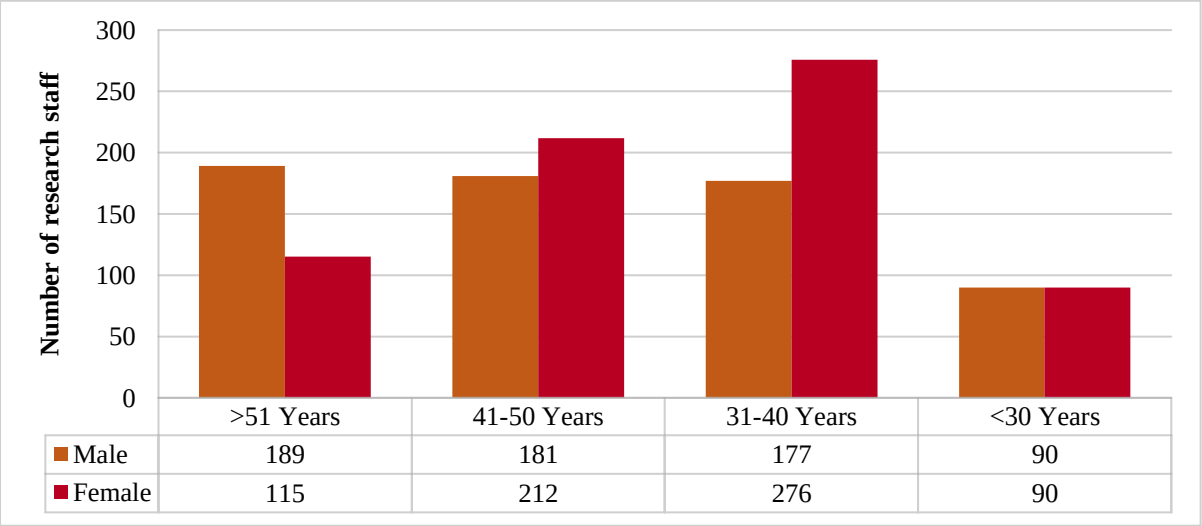
1.6. Research staff Age distribution.

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

[24] https://www.unesco.org/reports/science/2021/en
[25] Sri Lanka University Statistics 2018 (UGC); https://www.ugc.ac.lk/downloads/statistics/stat_2018/Chapter4.pdf

economic globalization, ageing populations, increased demand for highly skilled labour, and the expansion of systems of higher education – the necessity of nurturing and promoting young researchers seems more urgent than ever[26,27].

The sample survey shows the majority of the researchers were in their mid-career age group 31-40 years (n = 453, 34%). Also, a significant representation of 23% was in the later career stage (Age > 50) and only 13% 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[28] (Figure 1.10).



	>51 Years	41-50 Years	31-40 Years	<30 Years
Male	189	181	177	90
Female	115	212	276	90

Figure 1.10: Age and gender distribution of research staff.

1.7.Highest education qualification of research staff

In this survey, the educational qualifications of research staff that were considered Ph.D., MPhil, MSc/MA, BSc, and Diploma. Figure 1.11 depicts the distribution of research staff based on their highest educational qualifications.

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

[27] 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

[28] Systematic literature review on sustainable human resource management (2019); https://doi.org/10.1016/j.jclepro.2018.10.091

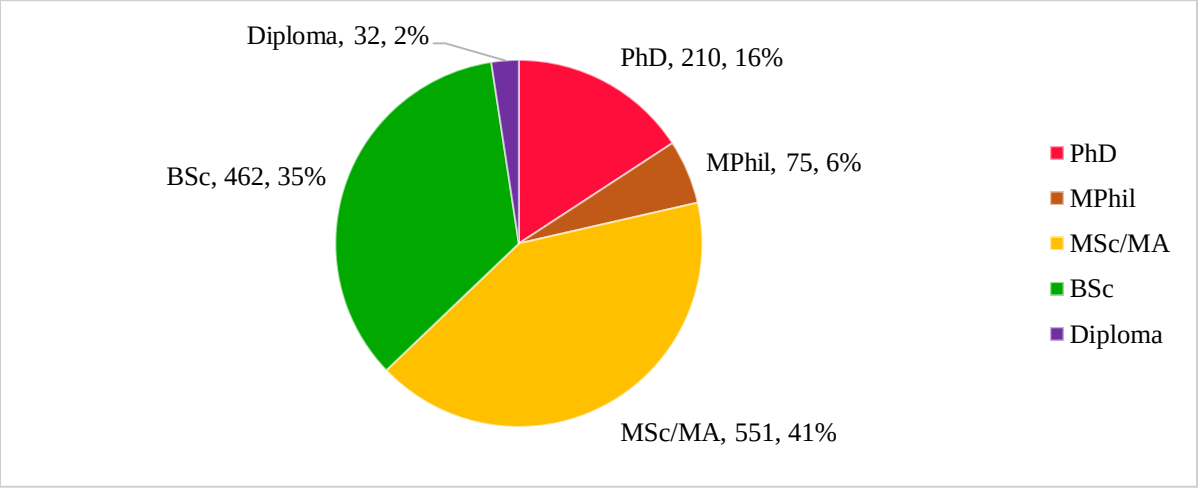
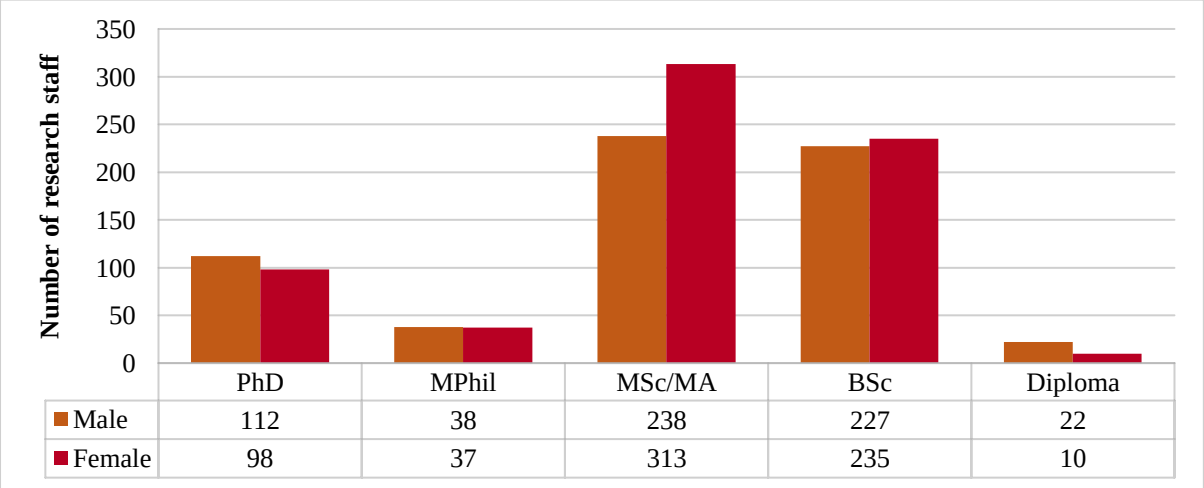


Figure 1.11: Distribution of research staff based on their highest educational qualifications.

A Master's Degree (MSc/MA) was held by the most research staff (n = 551, 41%), followed by a Bachelor's Degree (BSc) (n = 462, 35%). Only 6% of the researchers (n = 75) had a M.Phil, whereas 16% (n = 209) had a doctorate. The lowest percentage of research staff (n = 32, 2%) had a diploma as their highest qualification. The gender distribution of research employees is depicted in Figure 1.12 depending on their highest educational levels.



	PhD	MPhil	MSc/MA	BSc	Diploma
Male	112	38	238	227	22
Female	98	37	313	235	10

Figure 1.12: 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 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 S&T institutes carried out through workshops, seminars, and conferences. In line with this, in 2018, a total of 2985 scientific staff participated in 326 local training (47%) and 373 (53%) foreign training programs, respectively (Fig. 1.13).

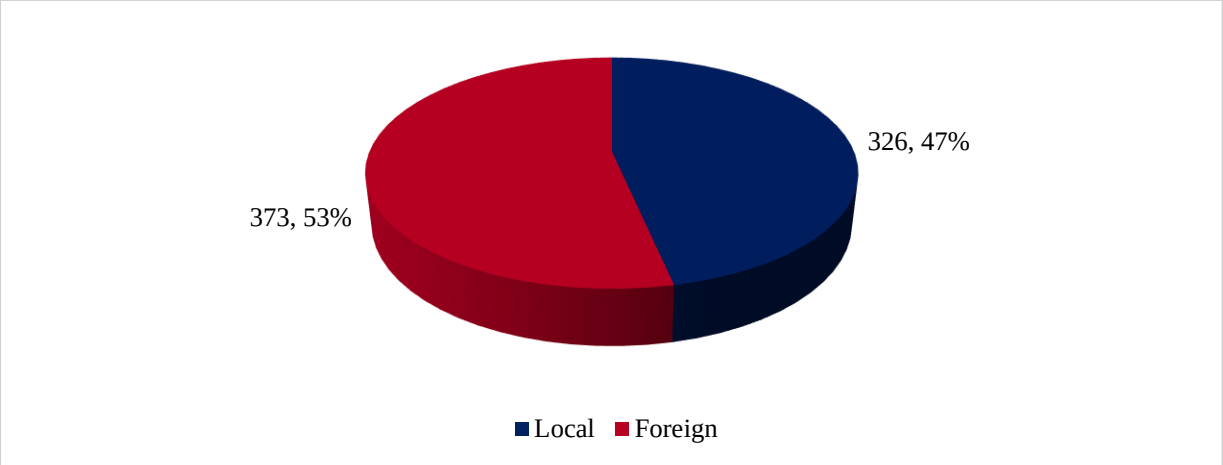


Figure 1.13: Composition of staff training programmes (local and foreign)

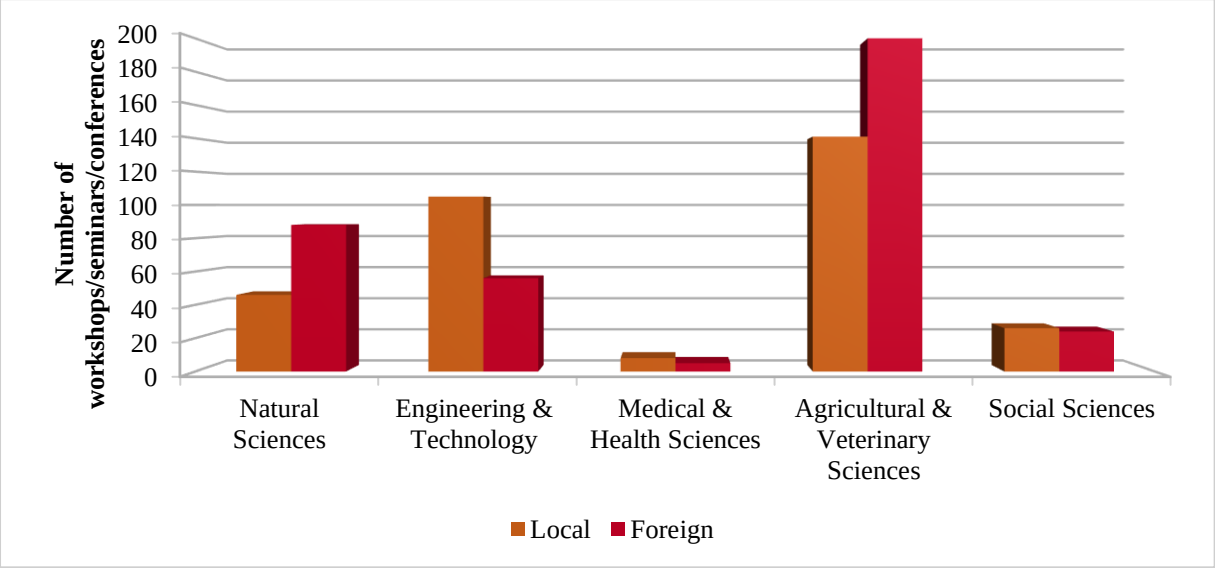


Figure 1.14: Sector-wise distribution of training programmes participated by the scientific staff

Two thousand nine hundred and eighty-five scientific staff attended in training programs, with 2450 (82%) receiving local training and 535 (18%) receiving international training. The trained scientific staff was comprised of researchers (n = 1113), research support personnel (n = 1841), and librarians/information officers (n = 31) (Fig. 2.11).

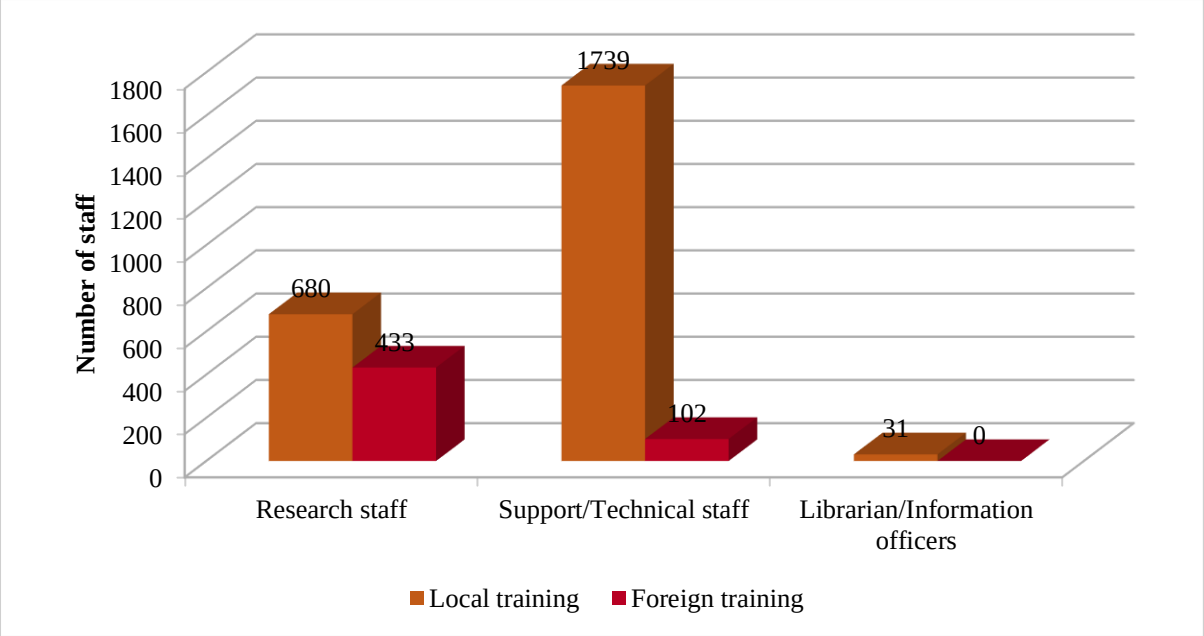
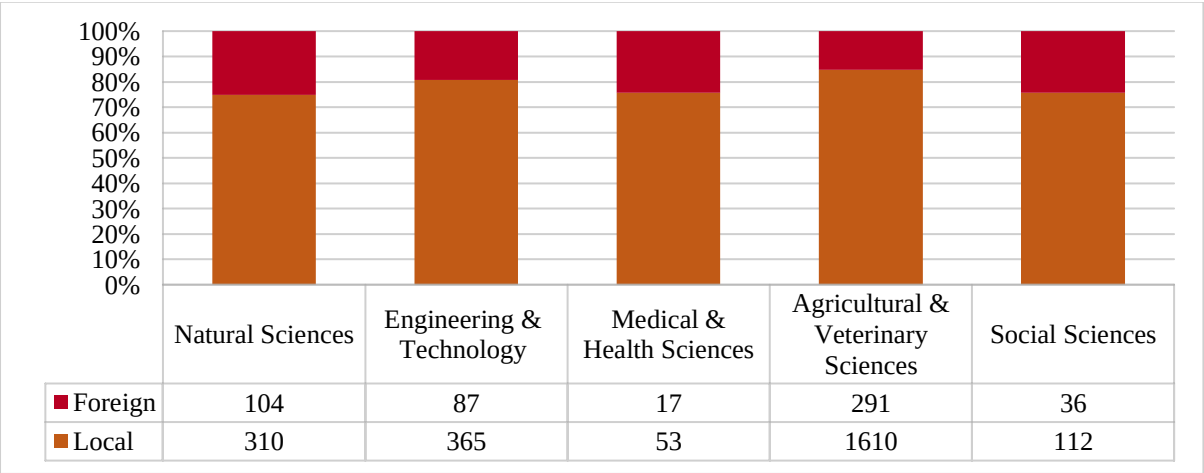


Figure 1.15: Training opportunities received by different scientific staff categories

Figure 1.16 illustrates the distribution of scientific staff attending local and international training programs by sector.



	Natural Sciences	Engineering & Technology	Medical & Health Sciences	Agricultural & Veterinary Sciences	Social Sciences
Foreign	104	87	17	291	36
Local	310	365	53	1610	112

Figure 1.16: Sector-wise distributions of staff training.

1.8.2. Employee turnover in the scientific staff

Employee turnover refers to the number or percentage of workers who leave an organization and replace by new employees for a defined period. In 2018 alone, the S&T institutes surveyed hired 186 scientific workers, comprising 69 research staff, 114 research support staff, and three librarian/information officers. During the same period, 205 scientific staff left the S&T institutes, comprising 79 research staff, 125 research support staff, and one librarian/information officer. Switching to a new profession, pursuing higher studies abroad, and retirement are all reasons for employee turnover. In 2018, the scientific staff surveyed had an estimated turnover rate of between 5% and 7%- the lower than the estimated average global rate of 10.9% in the same year. However, according to the UNESCO index, 50% of Sri Lankan expatriates hold a Ph.D.[29], which raises serious concerns about brain drain. It emphasizes the critical importance of addressing the current higher-end brain drain.

Tables 6 and 7 illustrate the number of scientific staff hired and the number of employees who left the S&T institutes surveyed in 2018.

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

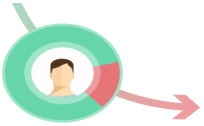
Scientific Staff Category	**Sector**					**Total**
	Natural Sciences	**Engineering & Technology**	**Medical & Health Sciences**	**Agricultural & Veterinary Sciences**	**Social Sciences**	
Research staff	4	31	1	22	11	**69**
Support/Technical staff	26	16	0	66	6	**114**
Librarian/Information officers	1	0	0	0	2	**3**
Total	**31**	**47**	**1**	**88**	**19**	**186**

[29] UNESCO scientific report 2021 ; https://www.unesco.org/reports/science/2021/en/south-asia

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

Scientific Staff Category	Sector					Total
	Natural Sciences	Engineering & Technology	Medical & Health Sciences	Agricultural & Veterinary Sciences	Social Sciences	
Research staff	6	20	2	41	10	**79**
Support/Technical staff	34	19	0	61	11	**125**
Librarian/Information officers	0	0	0	1	0	**1**
Total	**40**	**39**	**2**	**103**	**21**	**205**

(Source: UNESCO Science Report 2021- South Asia[30])



EMPLOYEE TURNOVER ESTIMATED (RESEARCHERS) RATE IN 2018= 5 -6%

**Average global employee turnover in 2018 = 10.9% (source: LinkedIn)*

1.8.3. Funding for higher studies

The number of scientific staff who were offered -funded for higher studies by their institutions is given in table 8.

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

Degree funded by the institution	Natural Sciences	Engineering & Technology	Medical & Health Sciences	Agricultural & Veterinary Sciences	Social Sciences	Total
PhD	0	5	0	32	2	39
MPhil	0	7	0	6	0	13
MSc	8	6	0	10	1	25
Postgraduate Diploma	1	0	0	2	0	3
TOTAL	**9**	**18**	**0**	**50**	**3**	**80**

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

In 2018, a total number of 80 scientific staff were funded by their affiliated institutions to pursue postgraduate studies. These included three postgraduate diplomas, 25 MSc degrees, 13 MPhil degrees, and 39 Ph.D. degrees. The highest number of degrees offered to employees was from the Agricultural and Veterinary Sciences sector (n = 50).

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 research allowance, medical insurance, and housing/quarters.

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

Perk	**No. of institutions**
Research allowance	16
Medical insurance	20
Transport facility/allowance	25
Professional allowance	29
Housing/Quarters	16
Communication allowance	8
Language allowance	2

2. PHYSICAL RESOURCES

2.1. Infrastructure facilities

Basic infrastructure is the 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

Sector	Laboratories	Workshops	Auditoriums	Libraries	Other
Natural Sciences	69	7	10	7	3
Engineering & Technology	65	7	12	4	7
Medical & Health Sciences	38	0	5	2	2
Agricultural & Veterinary Sciences	136	14	57	27	52
Social Sciences	7	9	7	2	2
Total	**315**	**37**	**91**	**42**	**66**

Common infrastructure considered in the survey included laboratories (n = 315), workshops (n = 37), auditoriums (n = 91), and libraries (n = 42). The “other” infrastructure (n = 66) 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 39 S&T institutes surveyed 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

Sector	Number of Institutes			
	Institutional Website	Database on Research/ Services	Internet	Other
Natural Sciences	6	5	6	0
Engineering & Technology	6	2	6	1
Medical & Health Sciences	2	1	2	0
Agricultural & Veterinary Sciences	21	17	21	2
Social Sciences	4	1	4	1
Total	**39**	**26**	**39**	**4**

2.3 ICT resource

Table 12 illustrates the availability of basic ICT facilities to scientific and non-scientific cadres. The total number of personal computers used by scientific to nonscientific staff was 2368: 1222. Overall, the scientific staff had access to more ICT facilities than the non-scientific staff.

Table 12 : ICT facilities available in S & T institutions in 2018

Sector	Computers		Printers		Scanners		Other IT facilities	
	Scientific Staff	Non-scientific staff	Scientific Staff	Non-scientific staff	Scientific Staff	Non-scientific staff	Scientific Staff	Non-scientific staff
Natural Sciences	302	182	93	71	7	5	0	22
Engineering & Technology	754	474	183	109	23	34	28	23
Medical & Health Sciences	29	35	18	12	7	4	1	4
Agricultural & Veterinary Sciences	885	461	454	268	55	40	180	135
Social Sciences	398	70	238	28	22	4	19	8
Total	**2368**	**1222**	**986**	**488**	**114**	**87**	**228**	**192**

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 sectorial master plans/strategies relevant to the respective line ministries/authorities.

3.1.1 The National Research and Development Framework (NRDF)

The NRDF is a comprehensive, cabinet-approved R & D framework that guides to 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 10 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, agriculture, and nutrition, (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 & 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[31]. 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 39 institutes surveyed, 25 institutions (66%) referred to NRDF, and 17 institutes (45%) referred to National Science and Technology Policy, as one of the source documents to prepare 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.

[31] National Research and Development Framework (2016); http://www.nastec.gov.lk/reports/nrdf

The highest number of institutes carrying out the interventions related to NRDF is for the focus areas of food, nutrition, and agriculture (n = 21), followed by the environment (n = 18), basic sciences, emerging technologies, and indigenous knowledge (n = 12), and water (n = 11).

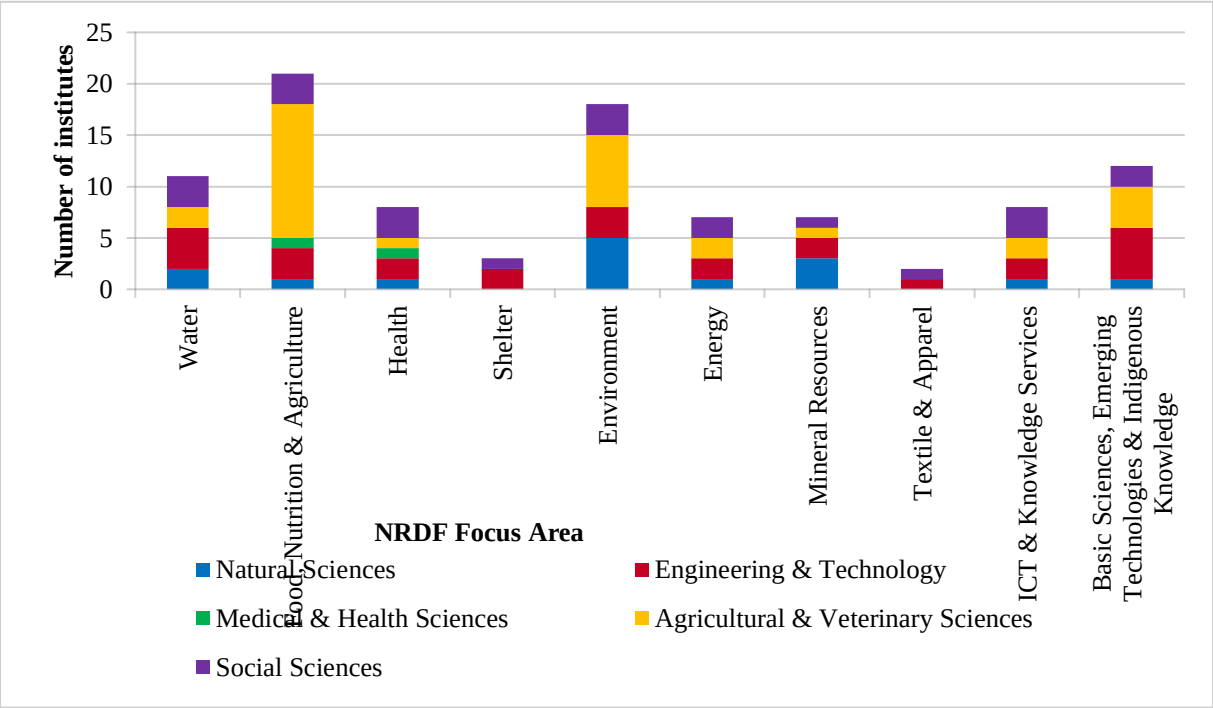


Figure 3.1: Institutes carrying out Interventions related to the NRDF's 10 Focus Areas

3 .2. Other Source Documents

In addition to the NRDF, the action plans of the pertinent institutes were generally guided by the policy directives and specifications of the corresponding line ministries and sectoral master plans, such as the National Agriculture Research Policy in the agriculture sector, the Forest Policy in the forest department, the Mines and Mineral Act by the Geology Survey and Mineral Resources Bureau, etc.

4. RESEARCH FUNDING

R & D advantages stretch across entire industries and have a favourable impact on the economy as a whole. Either way, a sector or country that spends extensively on R & D will grow and achieve more, including real-world advantages for its people, and has a better chance of long-term success.

For many countries, R & D and economic growth go hand in hand. Some form of R&D incentive often features part of a government's plans to grow its economy since they are designed to improve productivity. Globally, R & D spending has reached a new high of about US $1.7 trillion[32]. The United States and China are on top of on R & D spending. When breakthroughs are created that improve the lives of residents, even those who are most in need, the genuine advantages of R & D can kick in on a global scale.

The institutes were acquired funding from different sources, such as Treasury, National Science Foundation, National Research Council, foreign grants, and others. Funds received were categorized into four groups based on the nature of the activities for acquisition: 01) for research projects; 02) for science popularization activities which include conducting workshops; and seminars; 02) 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 2018, The S & T institutes surveyed received LKR 5348.22 million from the source of funders, of which LKR 4898.1 million (91.6%) was spent. The amount received by the institutions surveyed was 50% of the total allocation, and the amount spent was, 64 % of Actual incurred expenses for R & D activities in the reporting year's National R & D budget[33]. The highest amount was funded to improve the infrastructure facilities (LKR 2155 million, 40%), followed by conducting research projects with an allocation of LKR 2072.58 million. Of the funding for the research-based activities, a sum of LKR 2029.8 million (97.9%) has been utilized successively. The Treasury was the core funding source for research-based activities. The Agricultural and Veterinary Sciences sector received the highest funding for research

[32] UNESCO institute for statistics, 2020/08
[33] Annual Report 2018 - Ministry of Finance; https://www.treasury.gov.lk/documents/publications/anualReports/2018/Finance%20Ministry%20Annual%20Report%202018%20English%20updated.pdf

projects (LKR 1363.91 million). Table 13 shows the fund utilization by different sections, and Table 14 shows funds provided by various funding sources.

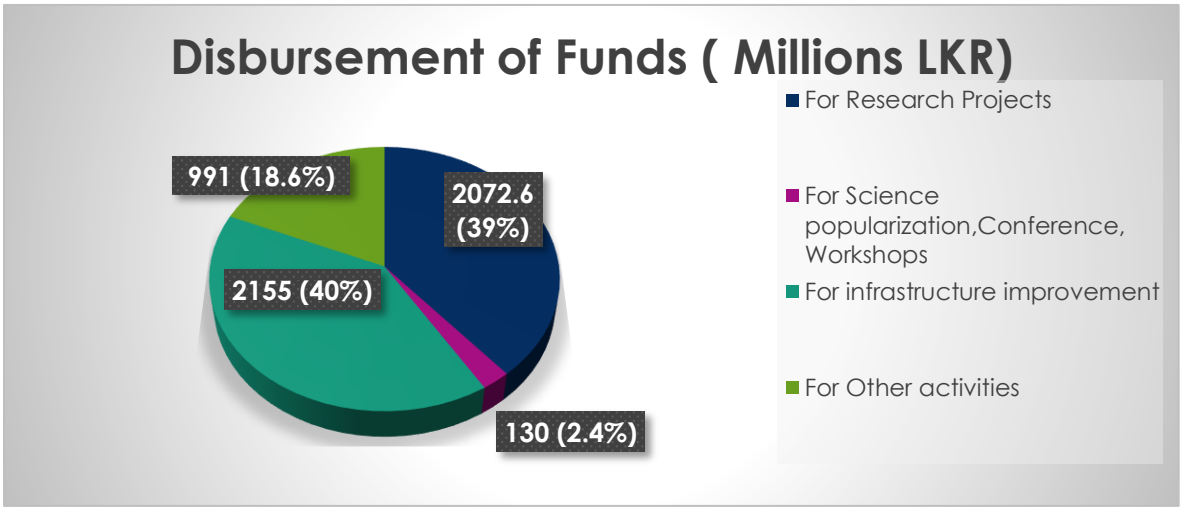


Figure 4.1: Disbursement of funds

Table 13 : Funds received for research projects: distribution among identified sectors

Sector	Funds Received / Rs. Mn.	Funds Spent / Rs. Mn.	% Utilization
Natural Sciences	232.82	219.34	94.2
Engineering & Technology	149.29	*178.48**	100.0
Medical & Health Sciences	26.00	19.10	73.5
Agricultural & Veterinary Sciences	1363.91	1288.32	94.5
Social Sciences	300.55	324.55*	100.0
Total	**2072.58**	**2029.80**	**97.9**

Table 14 : Funds received for research projects by different funding sources

Funding source	Funds Received / Rs. Mn.	Funds Spent / Rs. Mn.	% Utilization
Treasury	1639.16	*1670.75**	100.0
NSF	21.97	9.74	44.3
NRC	165.55	161.05	97
Foreign	78.49	58.83	74.9
Other	167.41	129.44	77.3
Total	**2072.58**	**2029.80**	**97.9**

** 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.

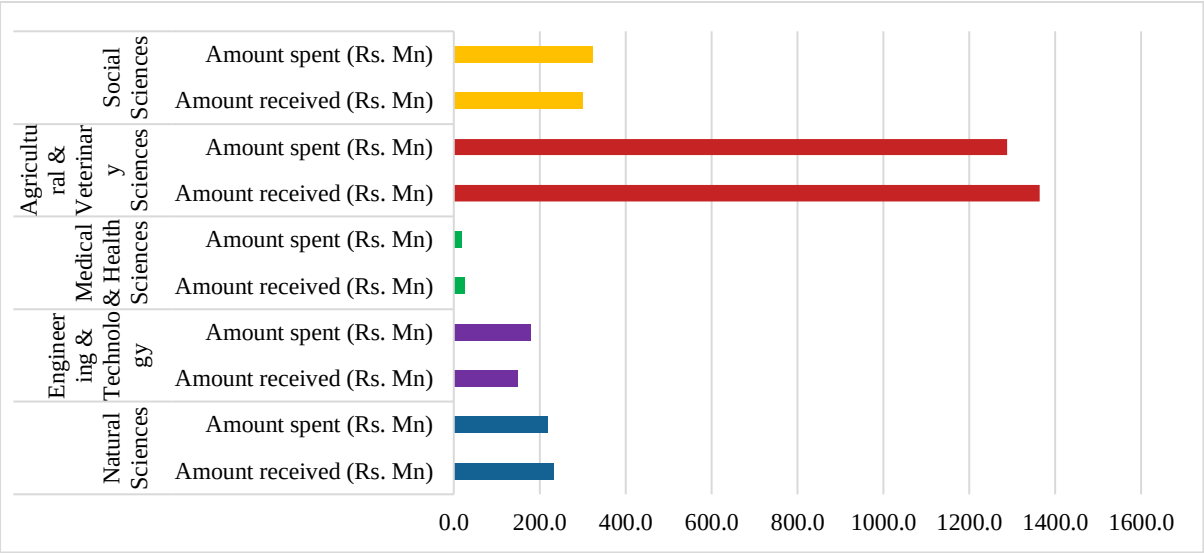


Figure 4.2: Funding for research projects, broken down by sector.

In 2018, the institutes surveyed received a sum of LKR 129.63 million for science popularization-related activities, workshops, and seminars, LKR 2155.22 million to upgrade the infrastructure facilities, and a sum of LKR 990.79 million to conduct activities than the above, respectively. Of the funds received, LKR 129.63 (100%) million for popularization work, LKR 1965.08 million (91.2%) for upgrading the infrastructure facilities, and LKR 772.42 million (78%) for other activities were spent respectively by the receiver. The activities related to the upgrade of the institution include the purchase of laboratory equipment, construction of buildings, and acquisition of land, vehicles, and properties.

Figures from 4.2 to 4.6 indicate the amounts of funding received and spent for different activities by the institutes.

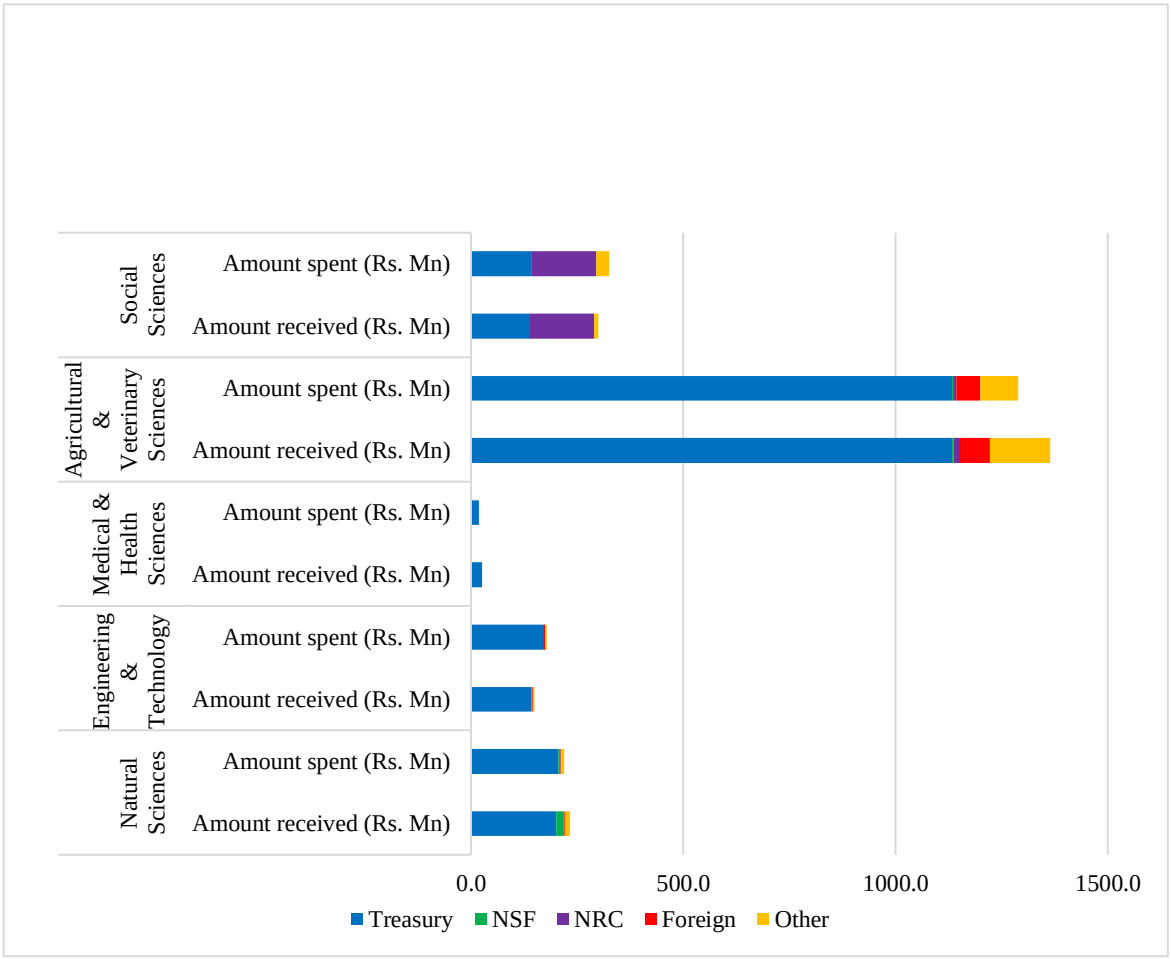


Figure *4.3: Funds received and spent by S&T institutions for different activities*

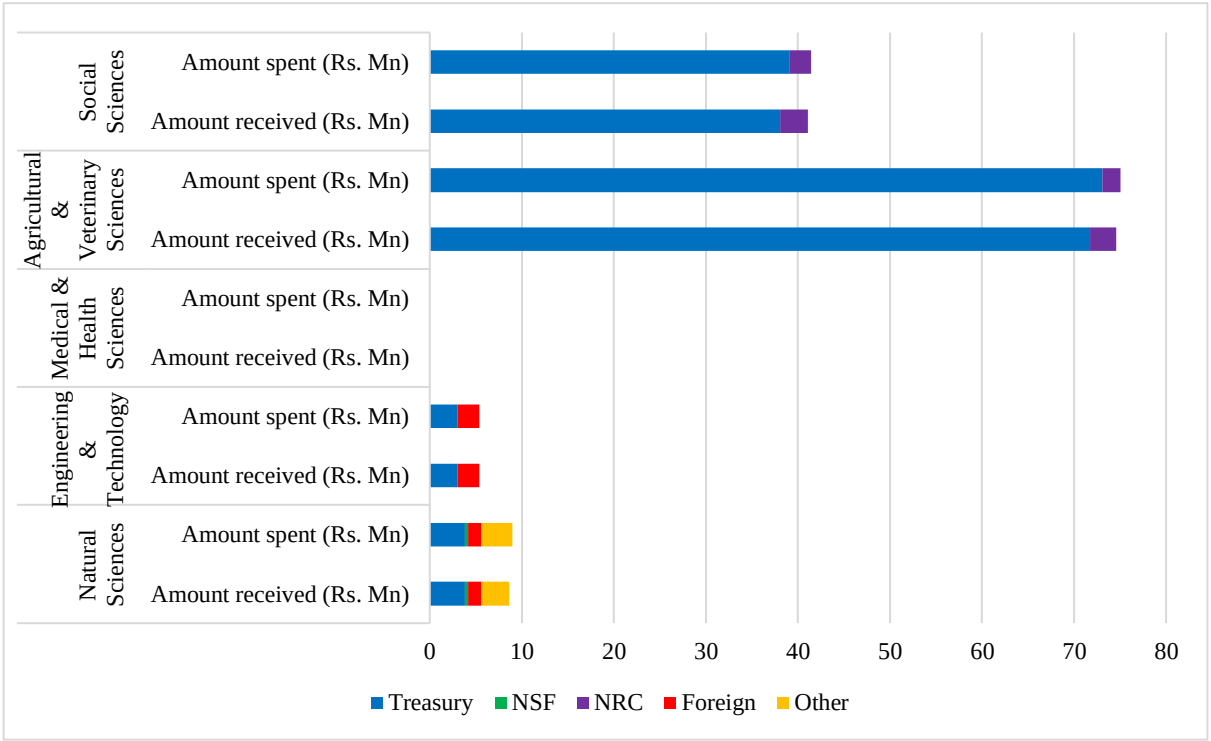


Figure 4.4: Funds received for research projects from different funding sources

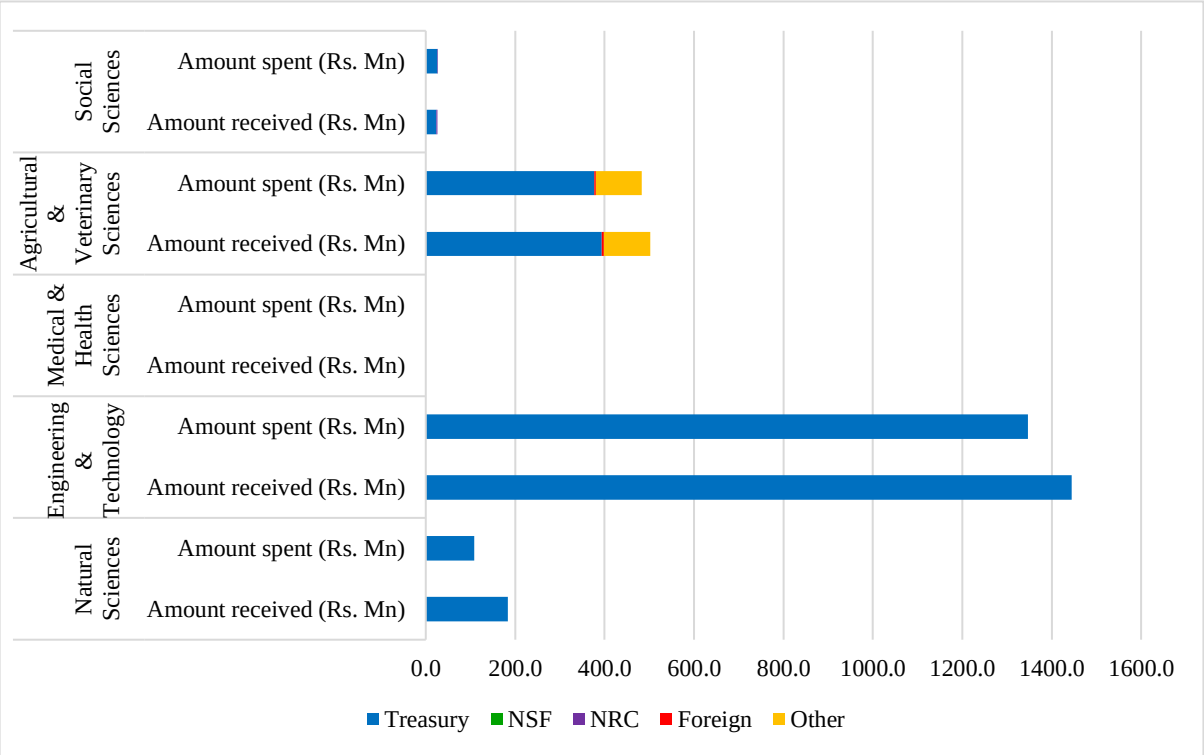


Figure 4.5: Funds received from various funding sources for science popularization, workshops, and seminars.

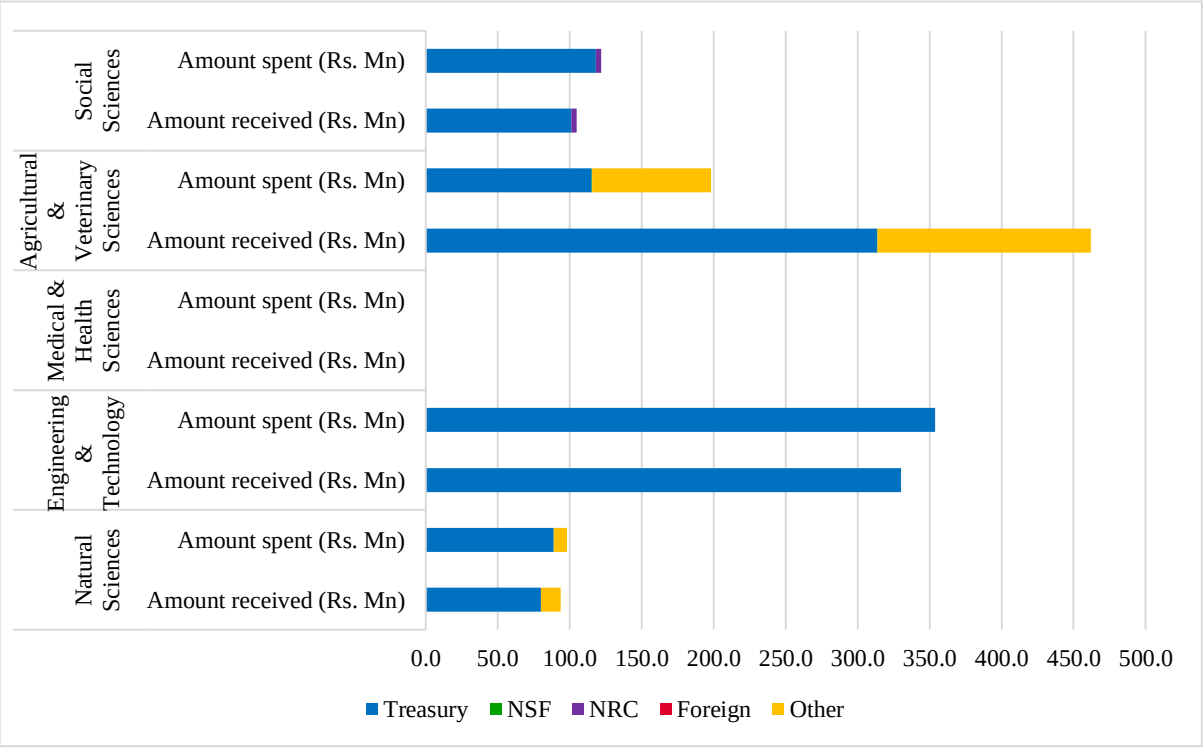


Figure 4.6: Funds received for the upgrade of the institute from different funding sources

A sizable share of funds was not spent within the fiscal year, particularly the allocations under other activities (22%). The reasons behind this were lack of human resources, lack of laboratory equipment, delay in receiving funds, equipment, and chemicals associated with barriers in the Government procurement-tender procedure, inefficient planning, and coordination.

Trends in research funding at public-sector institutes (distributed by the institute), 2012-2018

Based on the sample survey data from 2012 to 2018, 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 4.7)

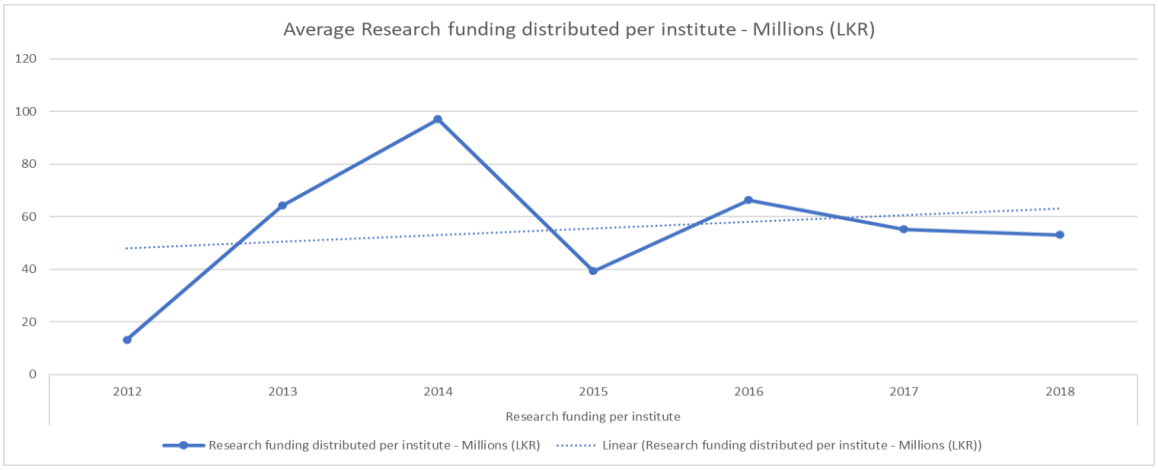


Figure 4.7: Research funding per institute.

Return on R & D Investment

According to UNESCO statistics, global investment in R & D increased by 19.2% between 2014 and 2018, with a direct proportional growth of 14.4% of total GDP (PPP)[34]. The SAARC regional statistics also show a recognizable upward trend of an 8% increase in spending, proportional to a 4% growth in GDP, respectively. For the same period in Sri Lanka, it has been noted as an upward trend of 51.6% and 14.0%, respectively[35, 36].However, the investment per share of GDP has had a downward trend since 1996 in Sri Lanka, with 0.13% in 2017,

[34]UNESCO science report 2021; https://en.unesco.org/news/unesco-report-calls-substantial-increases-investment-science-face-growing-crises
[35] Sri Lanka GDP per Capita PPP – Trading economics , World Banks; https://tradingeconomics.com/sri-lanka/gdp-per-capita-ppp
[36] Annual Reports , 2014-2018 , Ministry of Finance ; https://www.treasury.gov.lk/p/annual-reports

which is the latest available data, which has been the lowest proportion among the reported countries in the region[37].

Figure; 4.8: surge in Global research spending 2014-2018 (UNESCO)

Figure 4.9: Investment on R & D as share of Global GDP 2014-20 (Image Credit: UNESCO Science report 2021)

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

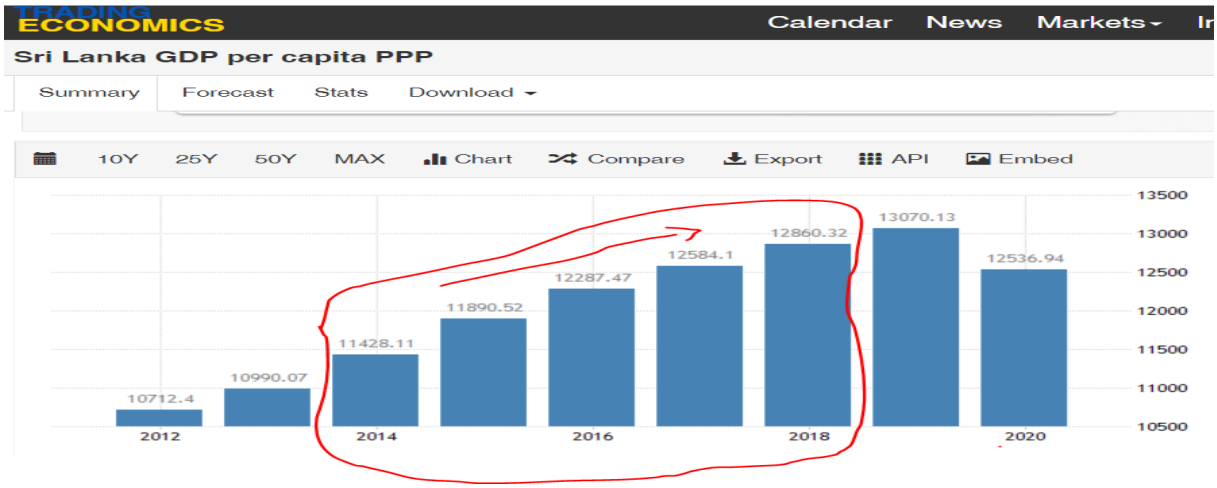


Figure 4.10: Sri Lanka GDP per capita PPP 2014-2018 (Source; World Bank)

5. RESEARCH OUTPUTS

5.1. Research projects

In 2018, the institutions surveyed carried out 942 research projects (Annexure 6) with a completion rate of 24% (n=224), 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.

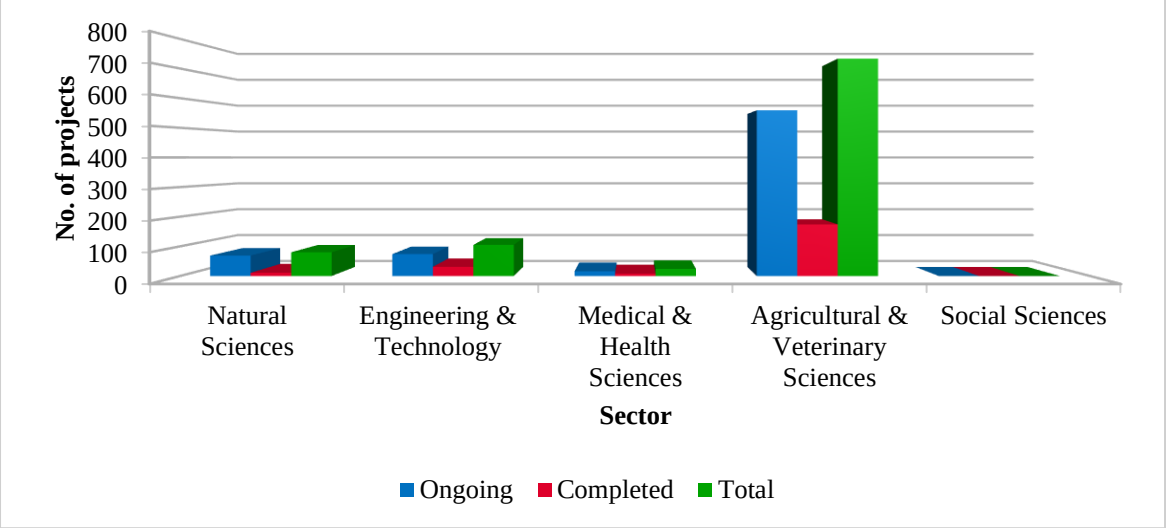


Figure 5.1: Research projects conducted by S & T institutions in 2018.

The highest number of research projects were conducted by the Agricultural and Veterinary Sciences sector (n = 733, 77%), of which 559 projects were ongoing and 174 projects were completed in 2018. The institutes that carried out the highest number of research projects included Rice Research & Development Institute (RRDI) (n = 229, 24.3%), followed by the Department of Export Agriculture (EAD) (n=150 projects), and Tea Research Institute (TRI) (111 projects).

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

With the world population predicted to exceed nine billion by 2050[38], societies are facing a range of issues, such as climate change, poverty, and ongoing urbanization. In order to deal with this, the United Nations adopted a set of Sustainable Development Goals (SDGs) in 2015

[38] https://en.wikipedia.org/wiki/Projections_of_population_growth

to be achieved by 2030. As a universal call to action to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity through the UN agenda[39], every member country is committed to achieving national targets in every context in society through creativity, know-how, technology, and financial resources. In this regard, state institutions have an increasingly important role to play in contributing to achieving these goals at a national level. It is of vital importance that the research projects and the funding of the institutions should be integrated into the national targets set out under the SDGs.

According to the survey, a substantial number of projects planned under R&D of the institutions were integrated to make the contribution towards SDG targets at a national level.

A snapshot of initiatives and activities proposed for implementation in S&T institutions' Action Plans in relation to the SDGs are depicted in Figure 5.2 and 5.3. The most research initiatives (n = 37; 14.4%) were integrated to make contribution towards SDGs targets set out for good health and well-being, followed by industry, innovation, and infrastructure (n = 28; 12.6%), and so on.

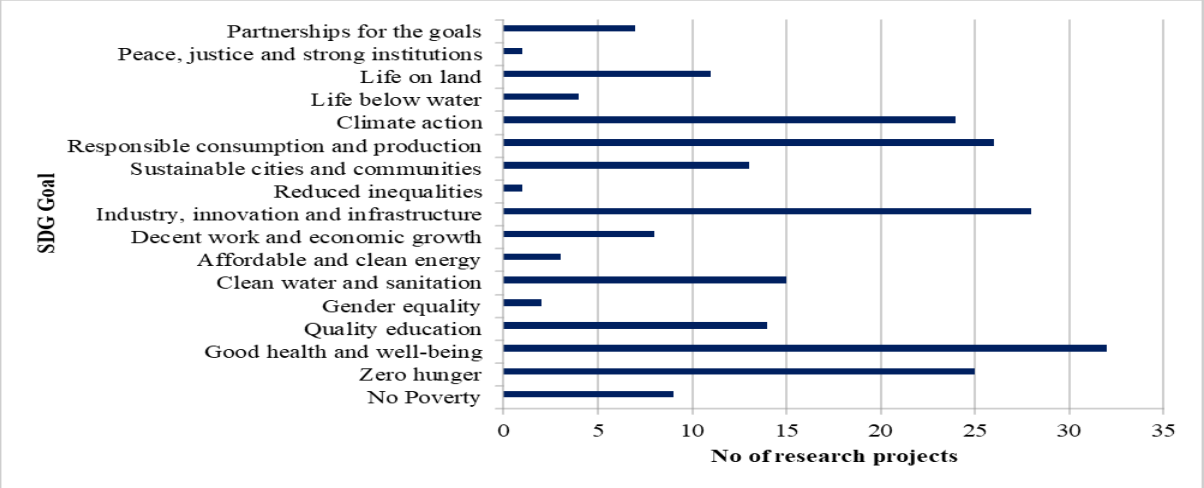


Figure 5.2: Line of Sight - Number of Research Projects (planned) in Alignment with SDGs.

[39] Sustainable Development Goal- United Nations Development; Programme (UNDP). https://www.undp.org/content/undp/en/home/sustainable-development-goals.html

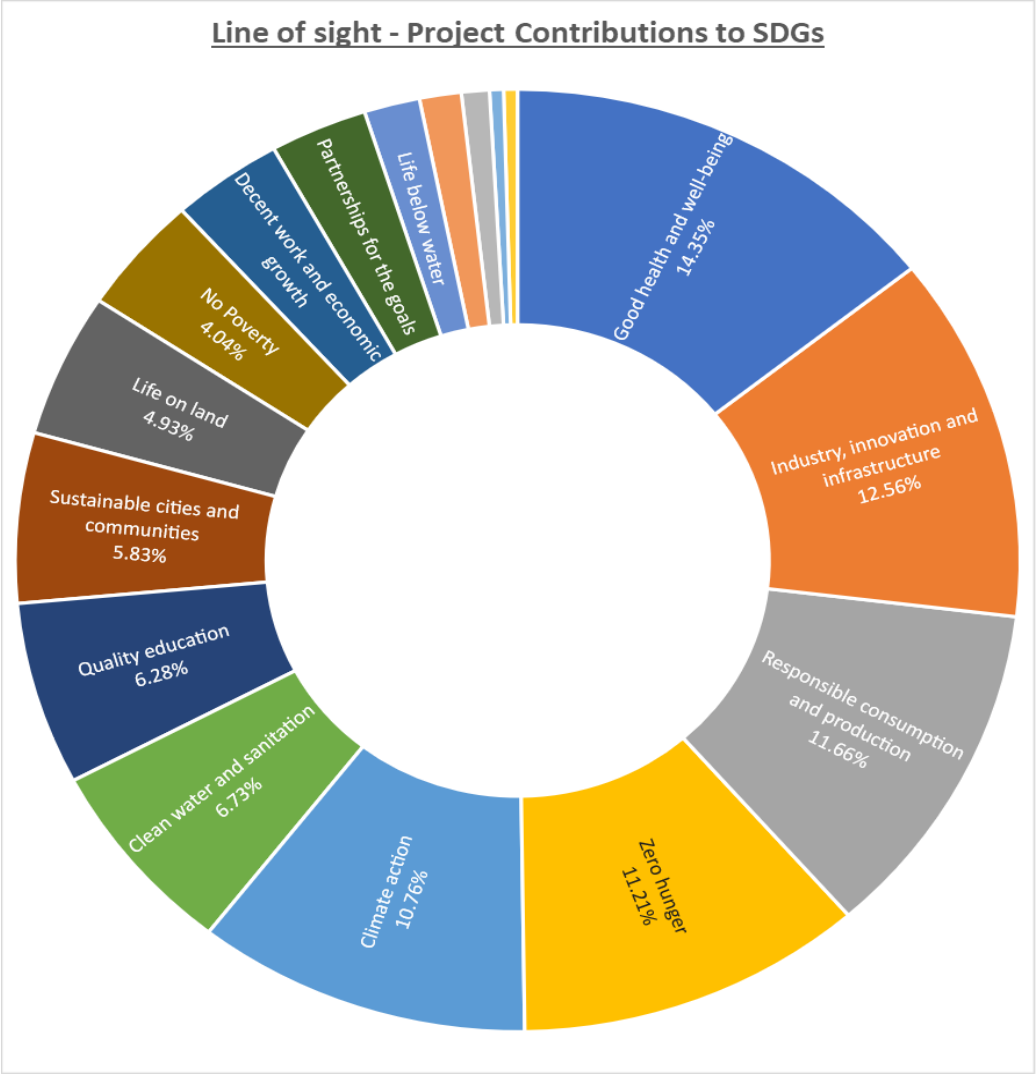


Figure 5.3: Line of Sight of Intended Project Contributions to SDGs

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

Through their research projects , S&T institutes developed 49 new products, 24 new processes, and 46 new technologies during the year 2018 (Annexures 3-5). Figure 5.4 indicates the sector-wise development of products, processes, and technologies.

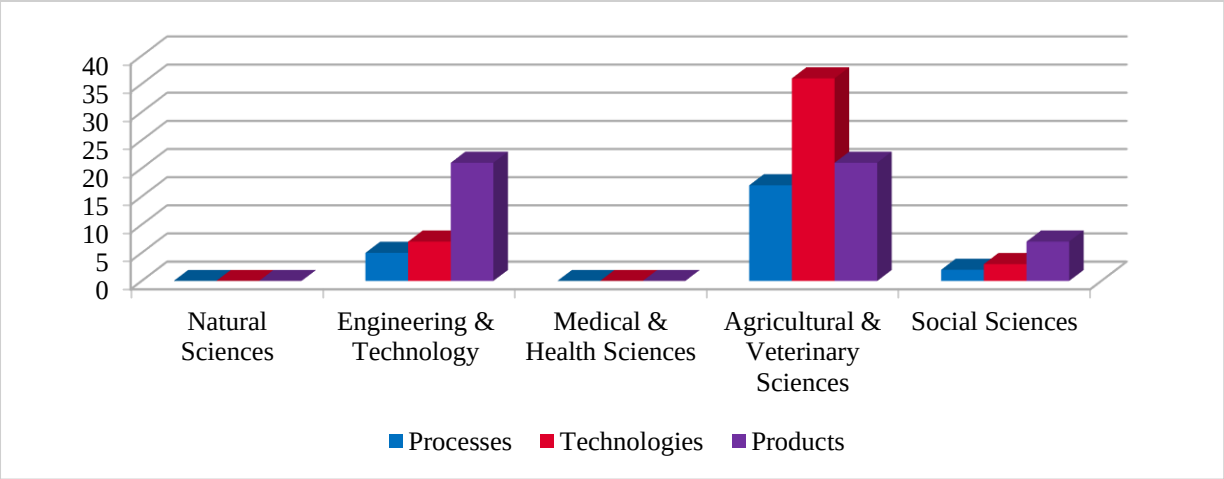


Figure 5.4: Development of new processes, technologies, and products in 2018.

5.4 Trend in research output (products-processes-technologies developed) across public sector institutes (distributed per institute), 2012-2018

As shown in the graph below, the number of product-process-technologies developed per institution fell over a seven-year period from 2012 to 2018.

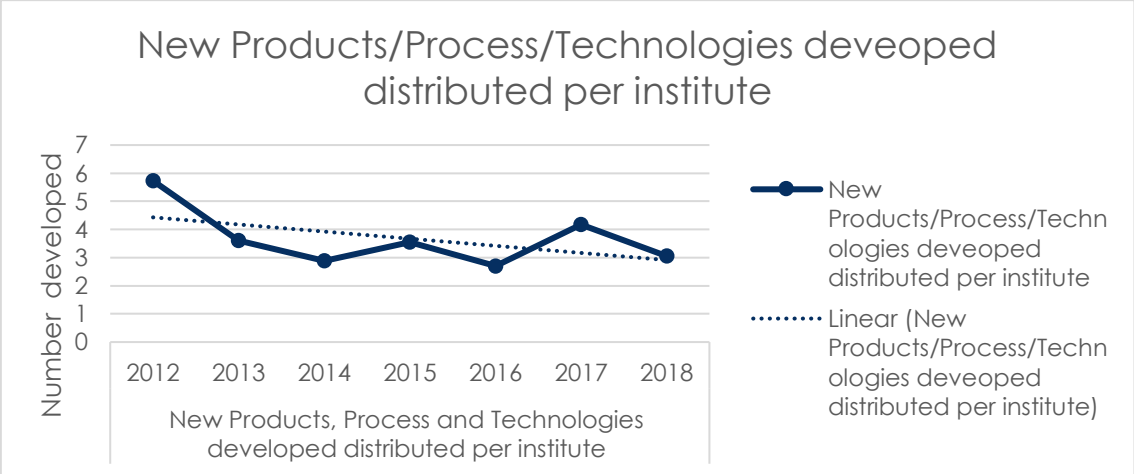


Figure 5.5: New products, processes, or technologies developed by the institutes surveyed between 2012 and 2018.

5.5 Number of Publications

The research carried out by the institutes and their subsequent outcomes were communicated (outreach and in reach) to audiences via publications, which included index journals (Science Citation Index and Science Citation Index Expanded), refereed journals, abstracts, monographs, books, and chapters in books, bulletins, newsletters, magazines, working papers, etc. The number of publications by S&T institutes published in 2018 is shown in table 15.

Table 15 : Various scientific publications produced by S& T institutions in the year 2018

Sector	Number of Publications								Total
	SCI Journals	SCI extended journals	Refereed Journals	Abstracts	Monographs	Books	Chapters in Books	Others	
Natural Sciences	81	20	23	184	0	2	5	135	450
Engineering & Technology	17	14	38	182	1	4	3	20	279
Medical & Health Sciences	4	0	4	16	0	0	1	1	26
Agricultural & Veterinary Sciences	32	11	51	240	3	4	12	336	689
Social Sciences	0	19	8	70	0	3	2	7	109
Total	134	64	124	692	4	13	23	499	1553

A total of 1553 publications were published by the institutions surveyed. The majority of the publications were research abstracts (n = 692) which were presented at symposia and conferences. The highest number of publications were from the Agricultural and Veterinary Sciences sector (n = 689) and Natural Sciences sector (n = 450).

5.6 Trend in Research Publications (Distributed per institute), 2012-2018

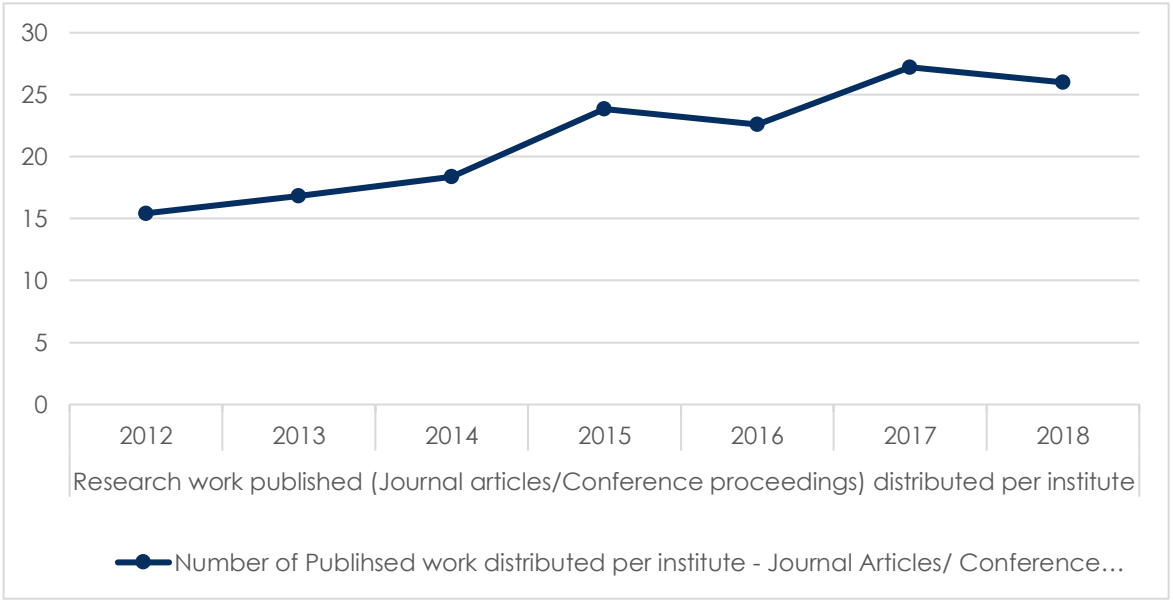


Figure 5.6: Per institute, research work is published and distributed.

*(*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

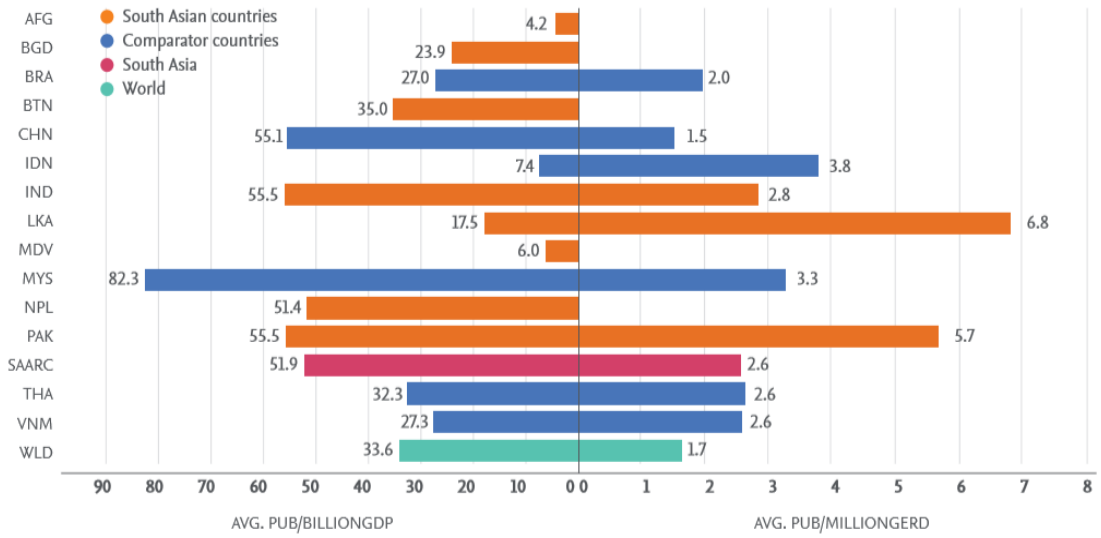


Figure 2

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[40])

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 average (2.6).

[40] 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

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

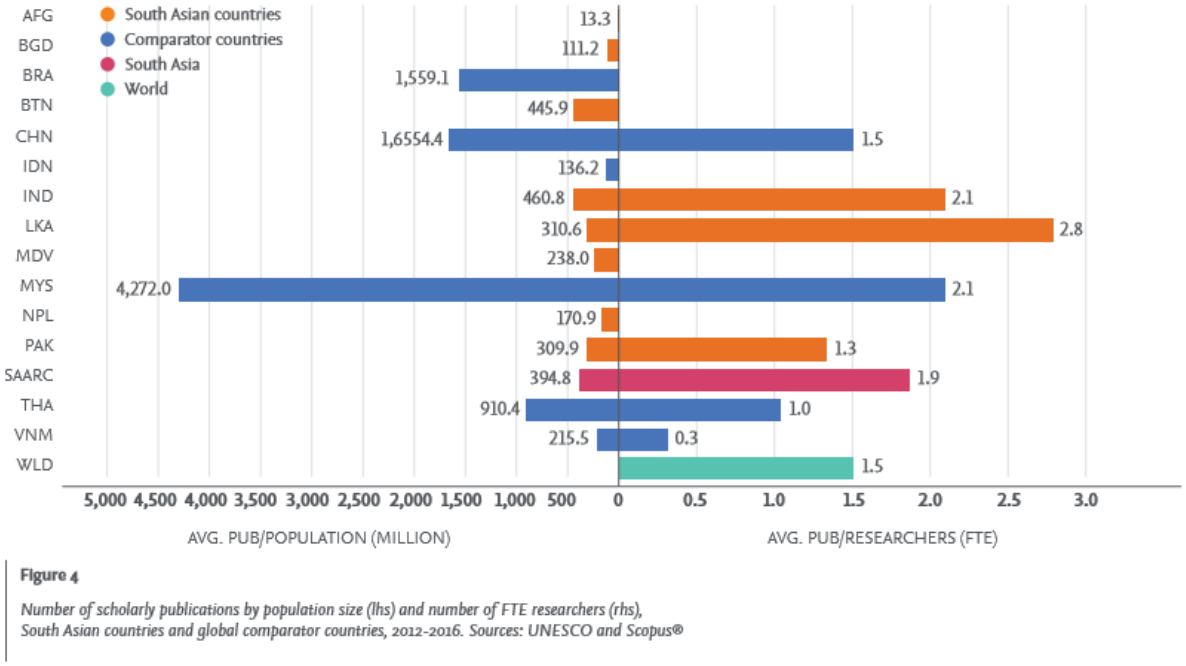


Figure 4

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 [41])

Sri Lanka generates more scholarly papers per full-time equivalent (FTE) to 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.

[41] 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 inhabitants largely reflects the economic strength of a country[42]

As per the survey, a total number of 19 products, including 18 national patents and 1 foreign patent were granted to the institutes. Five of them were implemented into practice (Table 16) The institutes that acquired the patents with respect to the numbers are GJRTI (3 patents), NIFS (3 patents), ITI (5 patents, 3 implemented), NERDC (1 patent, 1 implemented), SLINTEC (1 international patent), NIPM (2 patents), TRI (1 patent), and NRC (3 patents, 1 implemented).

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

Sector	Number of items patented	National patents		International patents	Patent implemented/sold
Natural Sciences	6	6		0	0
Engineering & Technology	7	6		1	4
Medical & Health Sciences	0	0		0	0
Agricultural & Veterinary Sciences	3	3		0	0
Social Sciences	3	3		0	1
Total	**19**	**18**		**1**	**5**

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

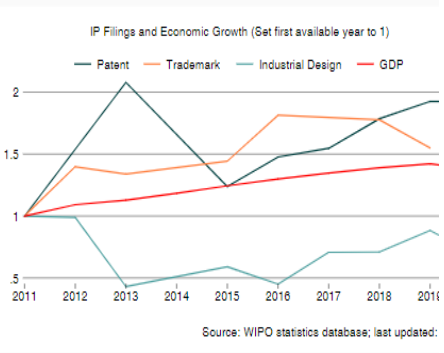


Figure 5.9: Source: Statistical Country Profile WIPO World [43]

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

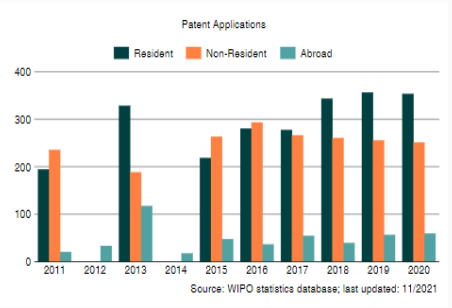
[43] https://www.wipo.int/ipstats/en/statistics/country_profile/profile.jsp?code=LK

5.9.2 The Patents filled and Granted between 2011 to 2018

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



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

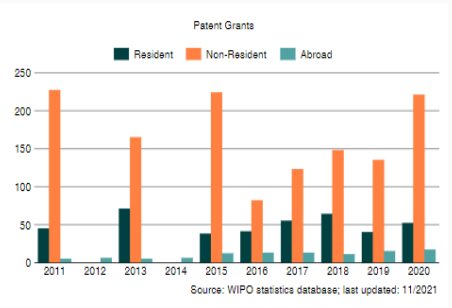


Figure 5.10: Source: Statistical Country profile WIPO world

In 2018, 64 resident patents were granted against 343 applications filled (Figure 5.10). Our sample survey captured 19 (30%) of them.

5.10 Awards received by scientific staff / institution

A total of 64 awards have been received by scientists working in the institutions, which includes 58 national and 6 international awards (Table 17).

Table 17 : Awards received by scientists/institution

Sector	**Total awards received**	**National awards**	**International awards**
Natural Sciences	29	29	0
Engineering & Technology	8	8	0
Medical & Health Sciences	3	3	0
Agricultural & Veterinary Sciences	24	18	6
Social Sciences	0	0	0
Total	**64**	**58**	**6**

5.11 Products and processes commercialized by the institution

In 2018, eighteen processes and forty-five goods were sought to attract possible primary consumer groups through various activities such as demonstrations, exhibits, mass media, and direct dialogues as part of taking research outputs into the market. Tables 18 and 19 represent the number of processes and products commercialized by the surveyed S&T institutes, respectively, and Figure 5.11 demonstrates their sectorial contribution.

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

Sector	Institute	Number of processes commercialized
Natural Sciences	DOM	3
	GJRTI	4
Engineering and Technology	NBRO	1
	NERDC	1
	SLINTEC	1
Medical and Health Sciences	None	0
Agricultural and Veterinary Sciences	DEA	4
	HORDI	1
	SCS	3
Social Sciences	None	0
Total		**18**

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

Sector	Institute	Number of products commercialized
Natural Sciences	None	0
Engineering and Technology	ACCIMT	1
	ITI	5
	NBRO	1
	NERDC	2
	SLINTEC	5
Medical and Health Sciences	None	0
Agricultural and Veterinary Sciences	DEA	4
	HORDI	2
	NIPM	2
	PRI	2
	RRDI	1
	SCS	2
	SRI	1
	VRI	16
Social Sciences	NSF	1
Total		**45**

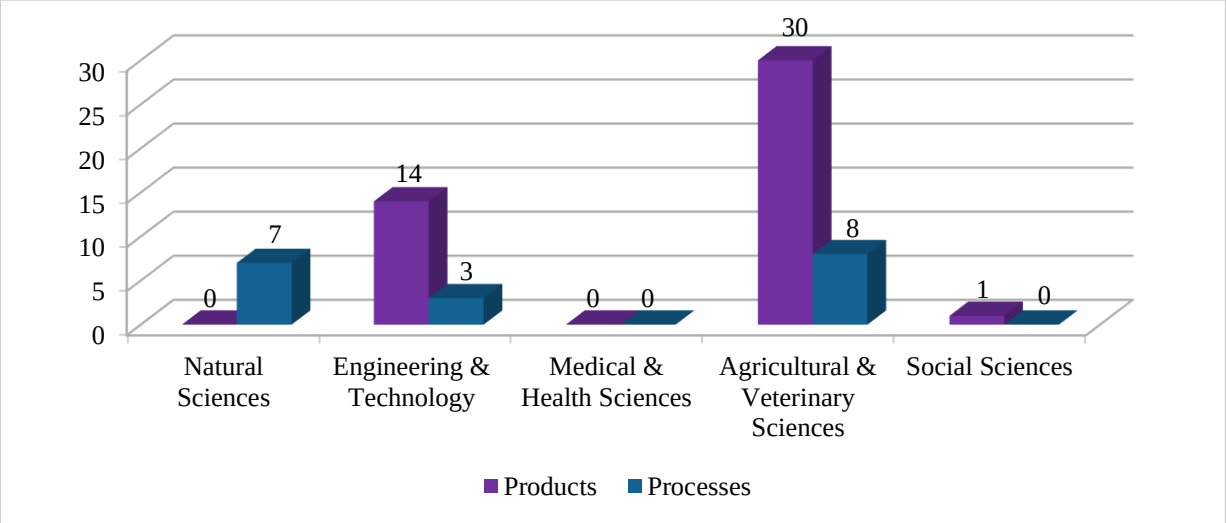


Figure 5.11: Commercialized products and processes in each sector

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

Technology transfer is the movement of scientific methods of production or distribution from one enterprise, institution, or country to another, 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.[44]

Within the year 2018, 64 technologies were transferred (22 in the engineering and technology sector, 41 in the agricultural and veterinary sciences sector, and 1 in the social sciences sector), and 34 recommendations were adopted (10 in the engineering and technology sector, 23 in the agricultural and veterinary sciences sector, and 1 in the social sciences sector). Figure 5.12 indicates the number of technologies transferred and recommendations adopted in each sector.

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

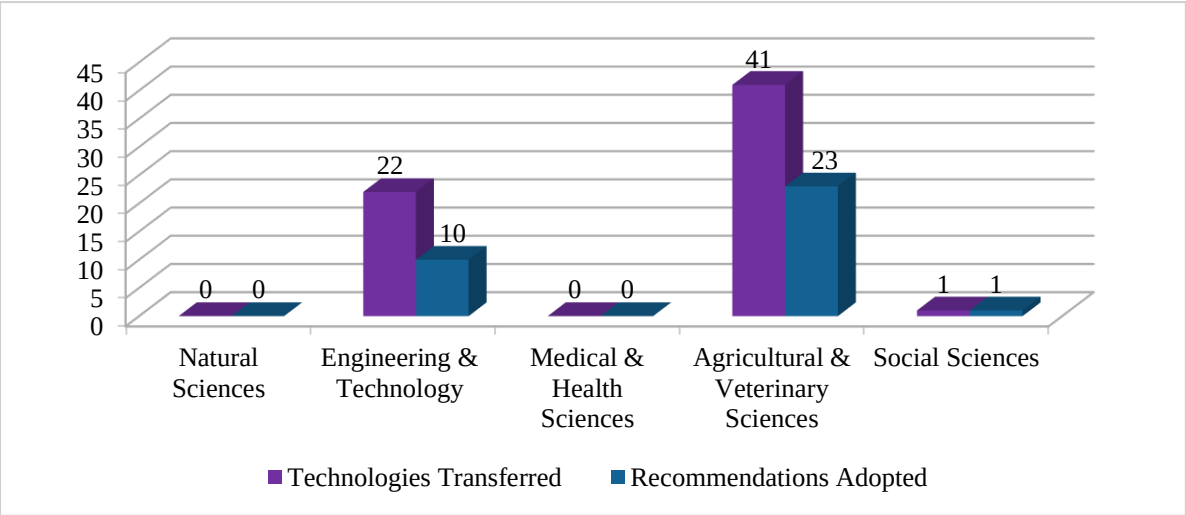


Figure 5.12: Technologies transferred and recommendations adopted in each sector

Several barriers that have been faced by institutions during technology transfer 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 industry, 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 agriculture industry has the most products, processes, and technologies per researcher (0.053, 0.014, and 0.073, respectively), followed by the engineering sector (0.038, 0.008, and 0.060, respectively).

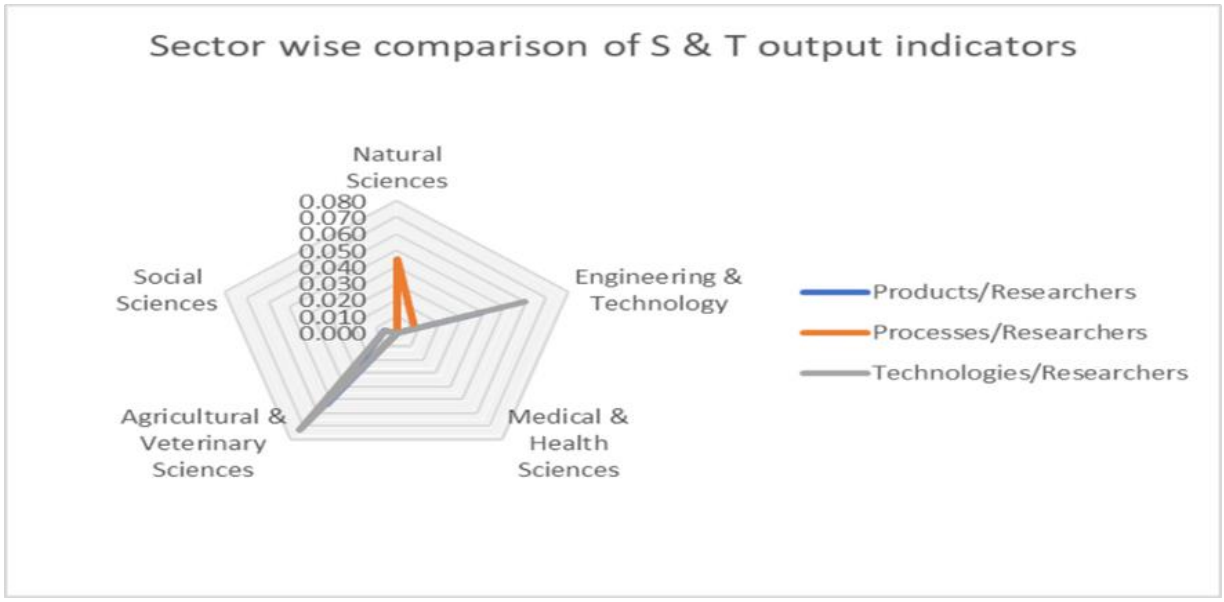


Figure 5.13: Radar chart comparing product, process, and technologies per scientist by sector in 2018.

5.14 The impact of published scholarly Works on the Relative Activity Index (RAI) and Field-weighted Citation Impact (FWCI) of SAARC regional perspectives.

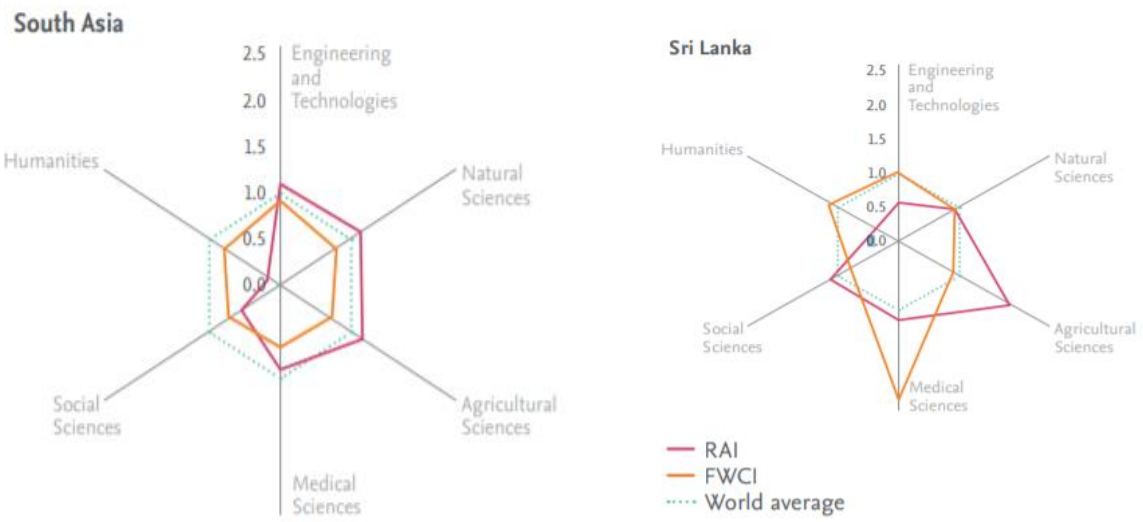


Figure 5.14: RAI and rebased FWCI for the world, South Asia, and Sri Lanka that published over 1,000 publications between 2012 and 2016. Source: Scopus®

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[45].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 2012-2018

Figure 5.15 depicts the overall trajectory of new goods, processes, and technologies developed at each institute from 2012 to 2018. The graph illustrates that the trend has been decreasing over time.

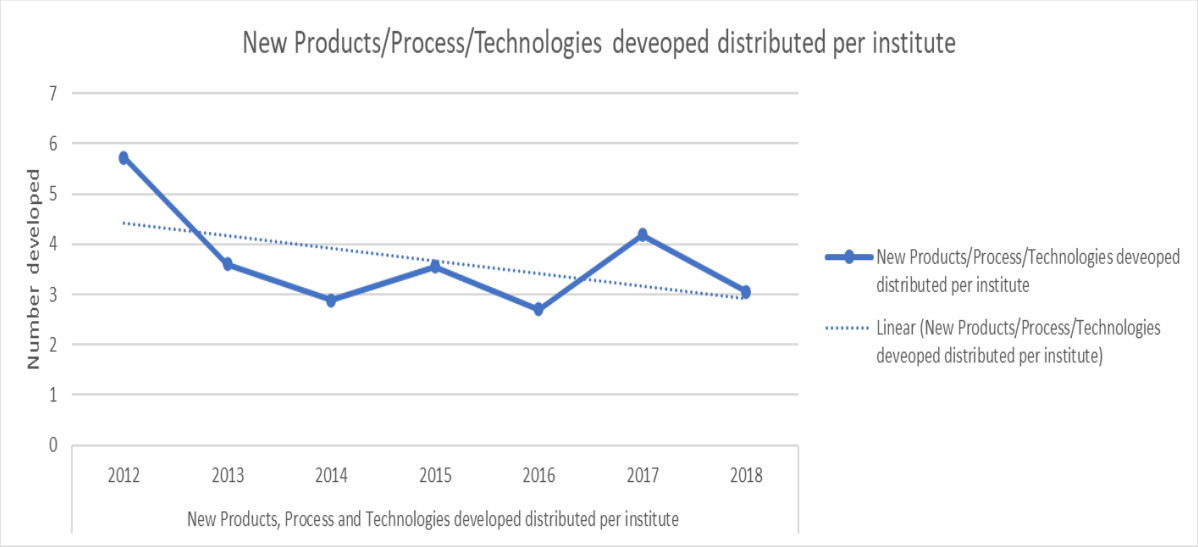


Figure 5.15: New Products-Processes-Technologies developed and distributed per institute
Source: NASTEC S & T Data platform

[45] 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 consultancies.

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

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

Sector	Testing	Calibration	Training	Product and Process Certification	Accreditation Services	Consult-ancies	Other Services	Revenue Earned (Rs. Mn.)
Natural Sciences	1,343	266	36,748	0	0	13	445	36.9674
Engineering & Technology	15,730	7630	2,650	0	0	3,871	942	918.746
Medical & Health Sciences	250,000	0	0	0	0	34,652	56284	11.6
Agricultural & Veterinary Sciences	96,051	0	50832	10931	0	749	8971	46.1903
Social Sciences	120	1,150	1,065	1,000	7	17	174	543.28
Total	**363,244**	**9,046**	**91,295**	**11,931**	**7**	**39,302**	**66,816**	**1,556.78**

The highest number of clients were served by the testing services (n = 363,244), followed by training services (n = 91,295). The medical and health sciences sector served the highest number of clients (n = 340,936), but the highest revenue was earned by the engineering and technology sector (LKR 918.75 million). The S & T institutes of all the sectors served a total of 581,641 clients in the year 2018, and a total revenue of LKR 1556.78 million was earned through client-based services. It should be noted that some S&T institutes provide their services free of charge. Table 21 indicates the levels of revenue generated by different S&T institutes.

Table 21 : Revenue generated by S&T Institutes in 2018

Revenue generated			
Rs. Mn. 0-9	Rs. Mn. 10-20	Rs. Mn. 21-100	Rs. Mn. >100
DOM	CEA	TRI	ITI
FMRC	GJRTI		NBRO
NERDC	ACCIMT		SLSI
SLINTEC	MRI		
DEA	NARA		
FCRDI			
HORDI			
NIPM			
NPQS			
PRI			
RRI			
SCS			
VRI			

6.3 Revenue Generation Trends by Institute, 2012-2018

Since 2012, there has been a rising trend in revenue generated by providing products and services to clients, with each institute generating an average of LKR 40 million in 2018.

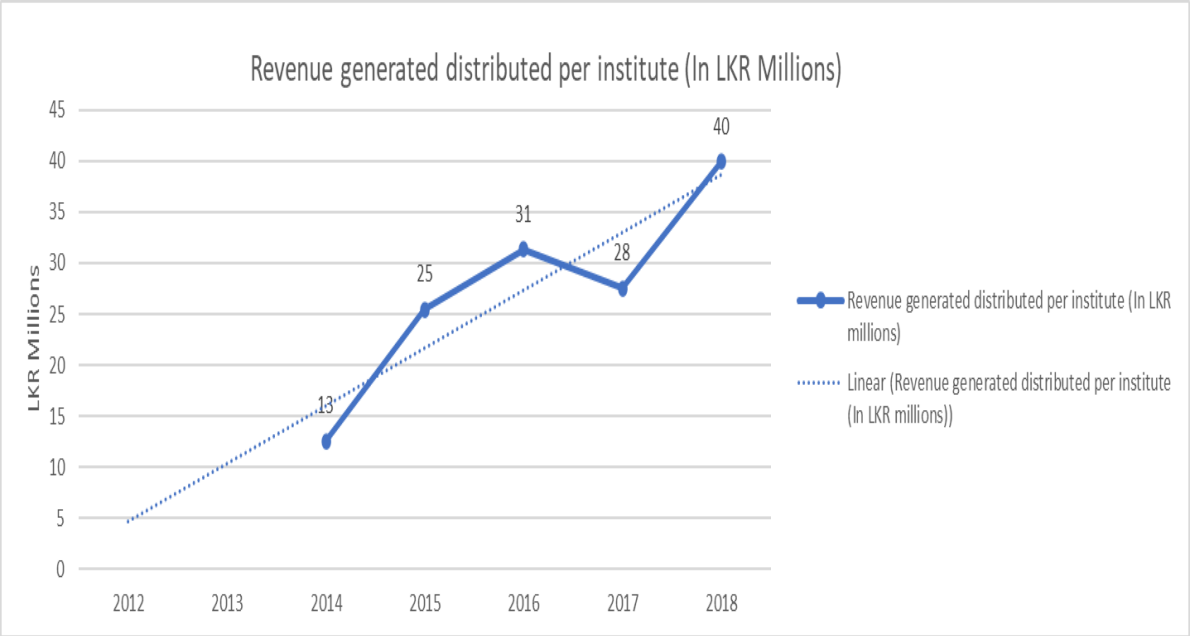


Figure 6.1: Distribution of revenue generated per institute, 2012-2018

RECOMMENDATIONS

Based on the data and information analysis, the following recommendations are made within the limitations stated in Section 01 of the report, Introduction that were encountered while preparing this report. Although many of the recommendations are well-known to the institutes, they are purposefully repeated in this document to emphasize the importance of implementing them. Implementing these recommendations will undoubtedly enhance the overall performance and the services provided by the institutions. Ultimately, this will contribute to climbing the country's index rank in the Global Innovation Index and similar indices.

The recommendations in the report are divided into five categories: human resources, physical resources, research input, research output, and S&T institution services.

1) Human Resources:

I- Employee turnover and brain drain:

Even though the employee turnover is lower than the average global rate that lies between 10% and 11%, particularly in the researcher's category, on a long-term basis, a systematic employee retention program needs to be developed and implemented to sustain employee retention at a national level.

II- It was found that there was a substantial disparity between the existing cadre posts and the filled cadre posts. It was more than doubled at several institutions, particularly in the staff category of researchers. It sends a strong message that all existing cadre positions must be filled immediately, at least to a certain extent, in order to keep the institutes performing the mandated activities smoothly.

III- More PhD candidates are urged to be integrated into research systems, and promote employee development programmes to ensure that researchers are retained.

a) Establish a national funding and incentive structure for researchers working in the system to boost the schemes. Promote the process.
b) Developing a National Research and Development Funding Policy and Strategies, which includes a recommended policy to provide appropriate

annual funding, incentives for researchers' work in S&T institutions, and a set of rules for effectively utilizing the funds in the research and development fields.

IV- Gender equality among employees working in the institutes must be fostered within the system in order to encourage increased female representation, especially in the sector of natural sciences and Engineering.

V- Young researchers should be encouraged to work with S&T institutions through the introduction of comprehensive and appealing programs.

2) Physical resources and 3) Research Inputs

Research planning and Funding:

VI- Increasing state funding for R&D that is guaranteed and continuous for long-term R&D endeavours.

VII- A platform for "Science Diplomacy" must be developed in order to obtain more foreign assistance money through collaborative and cooperative research activities with institutions overseas, addressing national concerns through the lens of regional concerns, and forging constructive international scientific partnerships.

VIII- A proper mechanism has to be developed to track the progress of funded projects annually through a national data base (i.e., a proposed system by NPD planning; NASTEC-NPD Project Monitoring System-a pilot study) [46].

IX- To improve the flow of S & T information in the domain and eliminate duplication in the existing system, a common platform must be built to house all S & T institutional research databases while ensuring intellectual rights.

X- A unified, efficient research equipment inventory system must be created, with a percentage of usage time and availability, especially for high-calibre experimental laboratory items. It will enable institutes to share their services across all institutional research activities, avoiding the need to buy new equipment just for a single project. It will also promote output-based project models and improve collaboration between institutions and researchers.

[46] Shahmy, Seyed. (2019). Science Technology Innovation Data Mechanism: from Creation, Management to Application in Sri Lanka. 10.13140/RG.2.2.36490.00969.

XI- It is recommended to design an R & D Data Sharing Policy with a set of implementation guidelines to support the development of a shared platform to host research data, which would also make provisions for the activities to come under the items listed in IX, X, and XI.

XII- A streamlined government procurement process could help to avoid delays in obtaining critical chemicals and laboratory equipment.

4) Research Outputs:

XIII- To support open research, creative publication on open-access platforms should be encouraged. In order to do so, an incentive-based approach with financial support is needed to cover the cost of publication fees. This support needs to be provided through outcome-based project models. Ensure that they are published in peer-reviewed scientific outlets, particularly in SCI-indexed journals. It will pave the way for a more open and transparent research culture while also emphasizing the necessity of researchers conducting high-quality research.

XIV- A mechanism for expanding the conference proceedings to include high-quality peer-reviewed articles must be created.

XV- Within the institutions, a central tracking system should be built to collectively monitor the progress of research and development projects that make a real-time contribution to the relevant SDG targets.

5) Services provided by the S & T Institutions:

XVI- The gap between the invention of a new product, process, or technology and its commercialization should be addressed as a matter of priority.

XVII- It is recommended that a national comprehensive invention and innovation policy with a set of rules be established, which will offer provisions and stimulate the activities related to commercialization. It will also enable institutions to function within a defined framework that encourages the market-based science-on-demand approach to produce high-quality and high-quantity products and services.

Conclusions:

Within the constraints, the S& T institutions considerably contributed to enhancing the performance of the national S&T ecosystem. The increased allocation for R & D funding is a timely need, and a systematic assessment has to be in place to monitor the long-term impact on the state funded R & D to ensure the alignment with the National Goals.

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 2018

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 S&T in the country. The information provided by your organization will be used only in the preparation of this report.

Please read the instructions and definitions attached to this questionnaire before you fill the questionnaire and please adhere to the format given in the questionnaire. **All the questions are relevant to activities carried out during year 2018.**

(I) GENERAL INFORMATION

1. Name of the Institution:

2. Postal Address:

3. Telephone:

4. E-Mail:

5. Fax:

6. Ministry/ Department:

7. 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	

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

(II) HUMAN RESOURCES

(Please provide information on both permanent staff and staff on contract basis for more than 6 months in year 2018)

A) Staff Strength

i) Scientific, accounting & administrative staff (headcount)

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) Research staff* based on areas of expertise & gender (headcount)

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

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

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

iv) Research staff* by age group and gender (headcount)

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

v) Staff remunerations

Categories of scientific staff	Salary scale	Minimum qualification sought at recruitment
Research Fellow		
Senior Research Officer		
Research Officer		
Scientific Officer		
Information Officer		
other		

B) HR Development

i) Scientific staff trained at workshops, seminars and conferences (local and international)

(Headcount) (*Please attach a separate sheet if necessary*)

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

ii) Postgraduate degrees funded by institution for scientific staff within 2018 (headcount)

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

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		
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 ……	
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) Perks given to research staff

Perks	Research 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
Laboratories	
Workshops	
Auditorium/Conference Hall	
Library	
other	

ii) Other facilities

Facility	Availability (Yes/No)
Institutional website	
Database on research / services	
Internet	
other	

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

Name of Equipment	Number	Year of purchase

iv) IT facilities

Facility	Number	
	Scientific staff	Administration staff
Computers		
Printers		
Scanners		
other		

(IV) RESEARCH PLANNING

I. Source documents referred in the preparation of Annual actiothe n 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 Innovation	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 2018

Funds received for	Source of funding	Amount requested (Rs. Mn)	Amount received (Rs. Mn)	Amount spent (Rs. Mn)
Research projects	Treasury			
	NSF			
	NRC			
	Foreign			
	Other			
Science popularization, Workshops, Seminars	Treasury			
	NSF			
	NRC			
	Foreign			
	Other			
	Treasury			

Upgrade of the institute*	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.*

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 tA broadsearch projects	Name of the research project	Collaborations if any *(International, other organizations, universities)*	Expected output/ outcome	Ongoing / completed
e.g.: 1. Food science				
2. Engineering				
3. Biotechnology				

ii) New products/ processes/ technologies developed through research during the year 2018 *(Please list and attach a separate sheet if required) (Please refer to section VI of Guidelines)*

	Processes	Technologies	Products
Total			

iii) No. of publications

Publications	Number of publications
SCI Journals	
SCI extended journals	
Refereed Journals	
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/institutions *(Please list)*

Item patented	Whether National/International	Whether implemented or sold

v) Awards received by scientific staff/institution

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

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

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

vii) How did the commercialization happen? *(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		
Training *(list the training programmes conducted to outside sourbys and indicate the number participated)*		
Product/Processes Certification		
Accreditation of Services		
Consultancies		
Others		

Annexure 03: Research Projects

ACCIMT

No	Project Title
1.	High Performance Surge Absorber
2.	Wireless Secured Data Logger
3.	National Center for Lightning Protection
4.	Wireless Irrigation System
5.	Centralized monitoring system for tests facilities
6.	Design and fabrication of a Smart Phone based ECG Trace Analyzer
7.	Establishing a Predictive Maintenance Unit
8.	Tea Colour Separator
9.	Fleet tracking system Sri Jayawardenapura Hospital
10	ADCS Testing system
11	Mode Identification of Oscillations of Delta Scuti type stars using multicolor photometry and high resolution spectroscopy
12	Study and Investigate the internal characteristics of SU Uma contact binary stars
13	A search for extrasolar planets around M-type dwarf stars using the NASA Kepler K2 Data
14	Remote Sensing based rice paddy harvested area estimation and yield prediction over Ampara District.
15	Assessing the level of impact on the environment caused due to mining related activities in Sri Lanka
16	Geographic information systems for Niche Modeling of Infectious diseases using remotely sensed environmental factors & boosted regression trees
17	MIS Development
18	Mobile App Development
19	RF Anechoic chamber
20	Nano satellite developments (1U)
21	Nano satellite developments (3U)
22	Hexa copter with high payload, Mapping Quad copter
23	Fixed Wing UAV

BMARI

No	Project Title
1.	Comparison of effectiveness of removing nitrogen on two different wastewater treatment process at crepe rubber factories in Sri Lanka
2.	The impact of green practices on Financial Performance: A study on small and medium sized enterprises in Sri Lanka
3.	Comparative study of Bioindicator species of water quality in selected urban wetland parks
4.	Studying the impacts of urbanization on wetland ecosystem in Colombo Flood Detention area using GIS/RS techniques
5.	Assessment of impacts of Mini Hydro Power Projects, giving special reference to biodiversity, for selected mini hydro projects in Kalawana Divisional Secretariat Division
6.	Study of BOD and COD ratio in different industry sector with a view to utilize one measurement.
7.	Survey on Environmental awareness level of the community in Kegalle.
8.	Impact of direct discharge of uncontrolled waste water from tourism industry to tributary of Kirindioya and aquatic life health quality assesement of the stream with respect to selected physico-chemical parameters and bioindicators (Odonate larvae).
9.	Study of water quality in vegetable wash water at selected locations of commercial vegetable washing by Checking COD, BOD and TSS.

CEA

No	Project Title
1.	Traditional Medical Knowledge Conservation Project
2.	Assessing the Drug Standardization anti oxidant activity and Activity of commonly used Ayurweda formulas for prameha
3.	The therapeutic and toxicity effect of commonly used ayurweda formulas For prameha (Diabetics Assessing induced mice Model)
4.	Standardization of Pippalyadyasawaya
5.	Assessment of bioactivity of selected Ayurvedic Treatment in Cancer Patients

DEA

No	Project Title
1.	Evaluation of field performance of rooted cocoa (*Theobroma cacoa L.)*(Narammala)
2.	Studies on variation of vegetative growth, flowering , fruit setting and yield of black pepper under different agro- ecological zones (Narammala, Matala, Walpita, Kolonna, Haldummulla)
3.	Effect of planting material originated from different cutting type on canopy development of Black pepper (*Piper nigrum*)
4.	Effect of soil moisture on flowering & fruiting habit of Black pepper
5.	Improvement of resource use efficiency of black pepper to increase the yield through support tree manipulation (Matale)
6.	Evaluation of different irrigation tecniques for Black Pepper
7.	Effect of micro - irrigation on yield performances of Areca nut + Pepper system
8.	Study the yield and growth performances of Cocoa under micro irrigation (*Theobroma cacao*.)
9.	Evaluation of cocoa peat as a potentioal substitute to reccommended potting media to cocoa (*Theobroma cacao*.)
10.	Evaluation of effect of fertilizer application time on growth and yield of cinnamon
11.	Evaluation of the performance of selected coffee cultivars (*Coffia* sp.) under coconut in low-country intermediate zone
12.	Evaluation of selected cocoa (*Theobroma cacao*) lines for intercropping with coconut in low country intermediate zone.
13.	Studies on use of soil moisture conservation methods and agronomic management practices for improvement of black pepper (*Piper nigrum* L.) productivity as climate change adaptation techniques
14.	Study the optimum shade level for producing export quality betel leaves (*Piper betle*L.).
15.	Effect of Irrigation and fertilizer application on inducing of flower initiation and yield of bush pepper throughout the year.
16.	Studies on productivity improvement of cocoa under coconut in Kurunegala District in Sri Lanka
17.	Study the potential use of coconut tree as a live supporting material for Pepper (*Piper nigrum*)
18.	Studies on effect of partially burnt paddy husk as an alternative nutrient source for growth and yield of betel (*Piper betle*).(field)
19.	Effect of different pruning levels on canopy development and yield of pepper
20.	Comparison of different potting/ nursery media used with coconut husk and coir dust for betel cutting production
21.	Pepper canopy improvement through different planting material originated from different cutting types and canopy training.
22.	Growth and yield performance of Macadamia VP plants at different spacing levels
23.	Effect of supplementary irrigation on establishment and early growth of Black pepper

24.	Studies on growthn performance of Cinnamon (*Cinnamomum zeylanicum* Blum) in cocoa peat as nursery pots
25.	Investigation of effect of source of nitrogen on growth and yield of black pepper
26.	Productivity improvement of cocoa through integrated soil and plant nutrients management under rubber and coconut
27.	Strategies for organic cultivation of Arabica coffee
28.	Development of land suitability classification for black pepper (*Piper nigrum* L) in Sri Lanka
29.	Development of soil conditioner using cocoa pod husk for reclamation of poor quality cocoa fields
30.	Effect of arbuscular mycorrhizal infections on occurrence of yellowing in Black pepper (*Piper nigrum* L.) plants under different soil moisture levels.
31.	Effect of cover crops on soil properties,growth and yield of pepper
32.	Sustainable methods of growing potted ginger for household consumption
33.	Recycling of pepper stalks for sustainable crop production in pepper plantations (*Piper nigrum* L) in Sri Lanka
34.	Study of inorganic fertilizer response and pest and disease resilience of new black pepper hybrid "Dingirala" variety in dry zone of Sri Lanka
35.	Determination of optimum pH level for growth of cinnamon
36.	Identification of visible indicators of cinnamon (*Cinnamomum zeylanicum* Blume) to monitor major and minor soil nutrients
37.	Effect of biofilm-biofertlizer on growth and yield of cinnamon
38.	Effect of compost and inorganic fertilizers and their combinations on growth and yield of cinnamon
39.	Effect of dolomite application on growth and yield of Cinnamon grown in acid soils
40.	Effect of growing gliricidia & legume cover crops on growth , yield and soil fertility status in Cinnamon
41.	Effect of applied sulphur containing fertilizer on growth and yield of Cinnamon (*Cinnamomum verum)*
42.	Effect of type of planting materials and different rate of inorganic and organic fertilizer on growth and yield of cinnamon
43.	Characterization of soil fertility status in betel cultivations.
44.	Fertilizer Studies in betel (*Piper betle* L.).
45.	Evaluation of department fertilizer mixture for single supporting system in betel (*Pipper betle* L) cultivation.
46.	Effect of different rates of inorganic fertilizer on different cultivars of Ginger
47.	Effect of different levels N, P and K fertilizers on growth, yield and qualty of the cinnomon
48.	Use of *Beauveria brassiana* for the control of coffee berry borer
49.	Investigations of biological control agents of coffee berry borer
50.	Effect of rhizome scales on germination and subsequent yield of ginger
51.	Screening of wild types of cardamom against thrips (*Sciothrips cardamomi*(Ramk.)

52.	Design a trap for coffee berry borer
53.	Evaluation of new hybrid black pepper varieties against insect pest damages.
54.	Occarence of insect pest and disease incidences in three commonly cultivated Black pepper (*Piper nigrum* L.) cultivars grown under different shade levels and climatic conditions
55.	Evaluation of collected Goraka cultivars for the resistance against the Oyster scale insect
56.	The awareness and use of pesticide usage of farmers on Export agriculture crops in Economic and technical perspectives
57.	Study the seasonal abundance, locality of spread and swarming period of cinnamon wood boring moth
58.	Establishment and evaluation of electric fence to manage vertebrates pests in cinnamon
59.	Identification of Pests of Betel (*Piper betle* L.) Cultivation and Appropriate Management Practices to Maintain the Export Quality of the Leaves
60.	Identification and studying the biology, ecology and management of cinnamon thrips
61.	Evaluation of catimore coffee progeny
62.	Multi-faceted crop improvement project on Black Pepper (NARP Project)
63.	Evaluation of Arabica coffee(*Coffea arabica)* accessions for yield, quality and resistant to major pest & diseases.
64.	Evaluation of promising cardamom lines for low elevation under Mahogony (Kiriella)
65.	Evaluation of different cocoa lines for different climatic zones (Matale, Badalkumbura)
66.	Molecular biological sex determination of Nutmeg.
67.	Finger printing of Cardamom accessions
68.	Fixing Geographical indication for pepper in Sri Lanka
69.	Fixing Geographical indication for coffee in Sri Lanka
70.	In-situ evaluation of local pepper selections
71.	Characterization of available cocoa (*Theobroma cacao* L.) lines and Establishment of a clonal garden
72.	Field evaluation of low elevation cardamom varieties under irrigation
73.	Collection, Characterization, Conservation and Utilization of *Piper* species exist in Sri Lanka
74.	Cocoa seed garden establishment
75.	Establishment of seed gardens from Lak Parakum Coffee
76.	Establishment of mother vine gardens using newly recommended Pepper Hybrids
77.	Exploration of Goraka (*Garcinia quesita* pierre and *Garcinia zeylanica* Roxb.) accessions based on chemical properties and establishment of a field gene bank
78.	Determination of QTL (Quantative Trait Loci) moleculer markers for quantitative charactors of Black Pepper (*Piper nigrum*)
79.	Identify the varietal difference in rooting of black pepper cuttings in cocoa - peat
80.	Evaluation and comparison of superior quality characteristics of Pieris cinnamon with selected cinnamon accessions (Sri Gemunu and Sri Wijaya)

81.	Collection, establishment and evaluation of turmeric (*Curcuma domestica* L) germplasm under coconut.
82.	Collection, establishment, evaluation and conservation of betel (*Piper betle*) germplasm in Sri Lanka.
83.	Evaluation of ginger (*Zingiber officinale*) germplasm under coconut.
84.	Hybridization of selected black pepper (*Piper nigrum* L) cultivars for low country intermediate zone.
85.	A comparative Study of growth, yield and quality of Half-Sib progenies of Sri Gemunu & Sri Vijaya Cinnamon varieties
86.	Establishment of cocoa clonal seed garden
87.	Multiplication and evaluation of selected hybrid cinnamon plants under recommended agronomic practices for quality, growth, and yield performance
88.	Management of leaf fall (Leaf blight & leaf spot) disease of mature clove trees in clove growing areas
89.	Management of major diseases of ginger (*Zingiber officinale* Rosc.)
90.	Management of nutmeg leaf fall disease
91.	Application of biocontrol agent (*Trichoderma* sp.) on controlling black pepper quick wilt disease
92.	Investigation of below - ground soil biodiversity at three selected sites in three agro ecological zones of sri Lanka (BACC - DEA)
93.	Management of black pepper quick wilt disease through enhancing rhizosphere antagonistic microflora
94.	Studying etiology, ecology, symptomatalogy and histopathology of rough bark disease of cinnamon
95.	Study the effect of sea water for managing pests and diseases in cinnamon nurseries
96.	Study the white root disease infection, its pathogenicity and effect of ecological factors on the disease development in cinnamon
97.	Study about canker in cinnamon
98.	Screening of cinnamon germplasm to select resistant lines for exsisting pests and diseases.
99.	Study the disease progress curve and yield loss of canker incidents in cinnamon
100.	Study the effect of water stress on pest and disease incident in cinnamon nurseries.
101.	Investigation on use of indigenous techniques for controlling Bacterial Leaf Blight in Betel (*Piper betle* L.)
102.	Anti -fungal and anti-bacterial effect of the true cinnamon (*Cinnamomum zeylanicum* Blume) for skin and oral disease in human
103.	Determination of oil, oleo-resin and piperin content in pepper from different locations in Sri Lanka.
104.	Variation in chemical constituents of *Piper* species exist in Sri Lanka
105.	Natural colour preservation in mace
106.	Design, fabrication and evaluation of steam blancher for pepper
107.	Development of a small-scale coffee roaster
108.	Development of Nutmeg manual Halving tool

109.	Investigation of chemical properties of *Garcinia quaesita* L. (Goraka) fruit
110.	Determination of caffein content of Arabica and Robusta coffeee selections.
111.	Development of technology to produce value added products of Garcinia (Goraka)
112.	Design fabrication and evaluation of solar greenhouse dryer
113.	Effect of immature harvesting on the physical and chemical properties of black pepper (*Piper nigrum* L.)
114.	Quantification of heavy berries and light berries yield component and their physical chemical analysis at the time of mature pepper harvest in farmer level.
115.	Identification of critical hazardas in cinnamon primary processing and improvement of quality in cinnamon primary process by reducing hazards contamination
116.	Investigation on medicinal valuve of cinnamon base products
117.	Determination of chemical constituents & anti-oxidant properties of turmeric in Sri Lanka.
118.	Determination of chemical constituents & anti-oxidant properties of clove bud, stem & leaf in Sri Lanka.
119.	Determination of chemical constituents & anti-oxidant properties of nutmeg & mace in Sri Lanka.
120.	Determination of appropriate packaging material for bulk storage of pepper
121.	Analysis of physico - chemicals properties of turmeric powder available in Sri Lankan market
122.	Study the quality of cinnamon quills at three levels in value chain after primary processing in Sri Lanka.
123.	Development of soup cube by using cinnamon bark oleoresin
124.	Study the chemical and elemental composition of sandy textured bark tissues at different maturity levels
125.	Identification of chemical and element composition of sandy textured cinnamon bark
126.	Study the effect of sulphur- fumigation and packaging materials with keeping quality of cinnamon quills
127.	Comparative evaluvation of anti - diabetic activity of two introduced varieties (Sri Gemunu and Sri Vijaya) of true cinnamon (Cinnamomum zeylanicum Blume)
128.	Study the quality and quantity of true cinnamon in different Agro-ecological regions in southern province
129.	Development of value added products using waste betel (Pepper *betle*) leaves .(NARP)
130.	Introducing an ice cream using cinnamon oleoresin
131.	Field evaluation of grated nutmeg (*Myristica fragrans*) selections in Matale and Gasnawa
132.	Collection and Investigation for growth yield and chemical properties of different Goraka (*Gacinia quaseita*) selection in Sri Lanka.
133.	Comparison of growth and yield of pepper raised from orthotropic (terminal), plagiotropic and rooted cuttings.
134.	Comparison of growth and yield of pepper (*Piper nigrum* L.) raised from tissue cultured plants and single nodal cutting plants GK49.
135.	*In-vitro* propagation of Export Agricultural Crops (Goraka, Wallapatta, Pepper (Hybrids), Betel)
136.	Application of plant growth regulators (PGR) for flowering induction of clove and vanilla.

137.	Estimation of Crop loss in clove (*Eugenia caryophyllus*) due to occurrence of extreme weather events during flower bud development stage
138.	Field evaluation of seedling and air layered planting materials originated from different sized lateral and upright branches of high yielding nutmeg (*Myristica fragrans* houtt)
139.	Synchronisation of flowering and fruiting behavior of Grafted nutmeg(Myristica *fragrans*)in the context of climate change effects.
140.	Synchronisation of flowering and fruiting behavior of black pepper (*Piper nigrum*) cultivars (bootawerala, Dingirala and Kohukubumburerala) in the context of climate change effects.
141.	Effect of bending and application of growth hormones on the formation of shoots for vegitative propagation of cinnamon (*Cinnamomum zeylanicum* Blum)
142.	Evaluation of different plant raising methods for the production of betel (*Pipper betle L*) planting materials under shade nursery.
143.	Effect of different concentration of plant hormones (IBA and NAA) on rooting and growth of stem cuttings of cinnamon
144.	Technology innovation for large scale in-vitro multiplication of cardamom, pepper, ginger, turmeric and cinnamon
145.	In vitro Propagation of Betel
146.	In vitro Propagation of Coffee
147.	In vitro Propagation of Nutmeg (*Myristica fragrans*)
148.	Effectiveness of Measures taken to control Nutmeg Leaf Fall disease
149.	Comparision of total ecosystem benefits of pepper monocrop with intercropping and mixed cropping systems of pepper with special reference to kandyan home gardens
150.	A study on identification of the feasibility of expanding Vanilla cultivation in Central province Sri Lanka

FCRDI

No	Project Title
1.	Identification of onion, black mold complex and its biological control using *trichodoma spp*
2.	Ensuring food security through developing climate smart crop varieties and cultivation techniques in Sri Lanka
3.	Development of hybrid varieties of chili, maize and onion
4.	Seed multiplication and cropping technology development for onion Varieties
5.	Follow-up management of high quality onion seed production demonstration village

FD

No	Project Title
1.	Tree improvement
2.	Climate change
3.	Forest plantation management
4.	Natural forest management

FMRC

No	Project Title
1.	Modification of multi crop thresher as groundnut pod removing machine
2.	Groundnut decorticator
3.	4W Tractor coupled vacuum seeder
4.	Pulse processing machine
5.	Seeder for paddy nursery
6.	Cowpea Thresher
7.	Tiller for boggy land

GJRTI

No	Project Title
1.	Exploration and assessment of Gem deposits in Sri Lanka
2.	Chemical and Mineralogical Characterization of gem deposits of Sri Lanka
3.	Development of mapping methodology using GIS and Remote sensing techniques
4.	Study for a sustainable alternative Material/ Method for replacing Timber and kakilla which are used for the structure of the a gem pit
5.	Development of Treatment method to Enhance the colour and clarity of low quality gem stones of Sri Lanka
6.	Characterization of Corundum in Different Gem Fields and their potential for value addition
7.	Improvement of Quartz as a material for ornaments
8.	Investigation of Physiochemical Properties of gem materials and their potential medical applications
9.	Modification for Soldering material in Jewellery manufacturing Process
10.	Study on use of Gem Cutting Dust for improvement of physical properties of clay products
11.	Awareness Programs on Research Findings

GSMB

No	Project Title
1.	Nuclear Raw material Survey in Sri Lanka
2.	Soil Geochemical Mapping Programe
3.	Quaternary Mapping Programe
4.	Seismicity in Sri Lanka

HARTI

1. Socio Economic and Policy Analysis

HORDI

No	Project Title
1.	Development of F1 Hybrid and Open Pollinated Varieties and Production of Basic seed
2.	Mushroom Development Project
3.	Climate Resilient Project
4.	Development of new and rapid alternative techniques for heat and drought resistant screening of tomato
5.	Development of rust resistance bean varieties, through conventional and molecular breeding techniques
6.	Development of local Gerbera varieties with high commercial value, using conventional and molecular breeding techniques
7.	Bio Intensive Integrated Pest management Programme for management of cut worm, Agrotis spp.
8.	Technology Dissemination of virus free seed potato Production hydroponic production system
9.	Development of fertilizer recommendation for hybrid vegetables
10.	Development of suitable nutrient management package for quality seed production of tomato
11.	Bioavailability of Cadmium in soil and plant accumulation due to TSP fertilizers
12.	Development of site specific fertilizer management system for sustainable vegetable production
13.	Development of Bio-intensive Integrated Pest and disease Management (BIPM) Programmes for major pest and disease of horticultural crops in Sri Lanka”
14.	Diversity of Ralstonia Solanacearum species complex causing Bacterial wilt in Solanaceous vegetable crops in Sri Lanka
15.	Management of Botrytis Blight of Lettuce and tomato in Polytunnels by cultural practices, biological control agents & safe chemicals
16.	Development of inbred lines in bell pepper through biotechnological breeding techniques
17.	Asian Network of Sustainable Organic Farming
18.	Effect of split application and combine use of different organic nutrient sources for growth and yield of vegetable crops

19.	Effect of continuos application of compost on vegetable yield
20.	Devcelopment of yield improving Nitrogen fixing microbial inoculums to enhance the growth and yield of vegetables
21.	Assessment of Nitrogen supplementing ability of selected Nitrogen Fixing inoculums for Capsicum
22.	Development of Botanical nitrification inhibitors to improve nitrogen fertilizer use efficiency
23.	Augmentation of drought tolerance in tomato crops using plant growth promoting Rhizobacteria (PGPR) inoculum
24.	Studying the minimum tillage effect on soil physical properties and crop yield
25.	Evaluation of different nutrients management practices on soil quality parameters
26.	Effects of changing farm yard disposal on the soil physical properties
27.	Effects of tillage practice on infiltration and soil strength of Reddish brown latosolic soils
28.	Perfection of agronomic practices to improve quality and quantity of cut flower roses
29.	Promotion of DOA recommendations of pesticides and fertilizers use among farmers in Badulla district
30.	Characterization and Management of Pathogenic *Fusarium* species caused for Bean Yellowing in Badulla District
31.	Soil test based fertilizer recommendation for Grama Niladhari Division and efficient fertilizer management
32.	Potato production programme
33.	Development of high quality innala variety for Sri Lanka
34.	Effect of different carbon sources on ripening, postharvest quality and shelf life of tomato
35.	Effect of Maltodextrine on Physical Properties of Spray Dried Fruit Pulp Powder of *Annona muricata* and *Annona reticulate*
36.	Effect of Osmotic Dehydration on Quality of Air Dried Green Chili Powder
37.	Production of durian (*Duriozibethinus*) powder by spray drying techniques
38.	Comparison of fresh and processed bee honey from Uva province of Sri Lanka
39.	Natural Wax coating to extend the shelflife of Papapya
40.	Identification of a suitable technology to store low sugar mango RTS in PET bottles
41.	Identification of a method for minimal processing of Waraka

42.	Production of vegetable based fruit drinks
43.	Development of processed food products for Mango variety- Tom JC, Karthakolomban and Villard using Vaccuum dehydration technology.
44.	Development of processed food products for vegetables.
45.	Development of processed food products for under-utilized fruits and vegetables using vacuum dehydration technology and other technologies
46.	Sensory acceptability and physicochemical qualities of Tofugu produced using Cowpea and Soy
47.	Evaluation of change of antioxidant properties during cooking in popular traditional rice cultivars and improved varieties.
48.	Development of rice milk shake fortified with fermented rice bran and fruit pulp
49.	Evaluation of selected traditional and improved rice varieties for nutritional and nutracuitical properties

ITI

No	Project Title
1.	Ensuring Human Health, Food and Nutrition security through Novel Cereal and Fruit based Prebiotics
2.	Biodiversity and technological potential of micro-flora from selected Sri Lankan dairies
3.	Studies in surface sterilization of spices using non-thermal processes
4.	Study on effect of processing parameters on the functionality of rice bran oil from local rice varieties and development of an appropriate bran oil extraction technique of SMEs
5.	Study of Poly Aromatic Hydrocarbons (PHA) in selected firewood smoke and development of a cottage level food smoker
6.	Development of self-stable high energy instant food products from locally available raw material using gamma irradiation
7.	Evaluation of bioactive properties of Sri Lankan Finger millet and determination of in vitro cholesterol assimilation effect of potential probiotics isolated from Finger millet
8.	Screening of Anti-Nutritional factors (ANFs) and activity of bio active proteins in locally grown edible legume varieties.
9.	Screening and assessment of Lactic Acid Bacteria from Sri Lankan dairies as source of functional ingredients for the industry

10.	Study on the use of sugar substitutes for food products, their detection and the development of low calorie foods
11.	Curing of bamboo culm that suit to tropical environment and bamboo products development
12.	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
13.	Rapid extraction of medicinal & aromatic plants and flowers & selective isolation of compounds by microwaves
14.	Development of *in-vitro* propagation technology for cultivation of *Stevia rebaudiana* Bertoni
15.	Development of technologies for sustainable raw material production for cosmetic industry using endemic *Gyrinops walla* Goertn
16.	Development of *Bacillus thuringiensis* microbial pesticide to control rice pests
17.	Extraction, isolation and formulation of plant protection products (PPP) from local medicinal plants for the management of sucking pests of fruits, vegetables and ornamental plants.
18.	Validation and value addition of bio-active natural ingredients for industrial application
19.	Identification of chemical fraction of *Tragia involucrate* L and the effect on hyperglycemi subjects
20.	Evaluation of *Cinnamomum zeylanicum* (Ceylon cinnamon) as a potential pharmaceutical age for diabetes mellitus
21.	Comprehensive utilization of Sri Lankan grown *Moringa oleifera* in developing health and herbal medicinal products to start up *Moringa oleifera* industry in Sri Lank
22.	Development of an anti-glycation and glycation reversing assay kit addressing all stages of glycation process
23.	*In silico* studies of drug leads from Sri Lankan natural products
24.	Evaluation of impacts of agrochemicals on grape wine cultivating soil and water and study of hea metals, nitrates and phosphates
25.	Investigation on natural fragrances and other volatiles from Sri Lankan flora and their industrial applications
26.	Development of nutritional instant porridge as a supplementary food for the patients with diabetic mellitus and cholesterol
27.	Rapid determination of coconut oil authenticity and quality with NIR Spectroscopy
28.	Value addition to essential oils by fractional distillation under vacuum
29.	Further work on production of high-quality graphene-based materials from local graphite for high-tech applications

30.	Development of red clay-based water filter /apparatus for removal of hardness in drinking water
31.	Reduction of vehicle exhaust emissions by nanoparticle supported adsorption material
32.	Conversion of Sri Lankan natural quartz to solar grade silicon for applications in electronic industries
33.	Cost-effective removal of synthetic organics (SOCs) and heavy metals from pesticides in aqueous phase using TiO_2
34.	Improvement of thermal conductivity of rubber using graphite based nanocomposite as a value addition
35.	Development of low cost, ecofriendly domestic system to compost bio degradable food waste
36.	Microbial bioremediation of soil and water contaminated with petroleum hydrocarbons
37.	Development of a DNA rabies vaccine for dogs
38.	Development of a diagnostic kit for the detection of anti-rabies antibodies in serum samples after post-exposure of rabies vaccination in humans
39.	Application of anaerobic digestion for treatment of poultry processing wastewater and determination of CH_4 and CO_2 emission factor
40.	Development of a wireless humidity and temperature data acquisition and monitoring system
41.	Development of landside detection sensor system
42.	Design and development of standard AC DC current shunt

MRI

No	Project Title
1.	Resilience among grade 10 adolescents in the Gampaha district: level, correlates and effectiveness of an intervention for its enhancement
2.	Prevalence of Obesity and its association with occupation among government office workers in Colombo district
3.	Prevalence, correlates of bullying and an intervention to reduce bullying among 12 – 14 year aged school going adolescents in government schools of the Kegalle educational zone
4.	An Interventional Study to Improve Report Delivery of Microbiological Investigations Done at MRI with Concern to Turn-Around-Time

5.	Correlation between intelligent quotient and grade five scholarship examination results of students in Kandy district, Sri Lanka
6.	Prevalence of chronic kidney disease, provision of primary care and effectiveness on an information package for improving detection, among medical officers in Gampaha District.
7.	Quality of life, Healthcare service provision, utilization and factors associated with defaulting among adult leprosy patients in the Western province.
8.	Prevalence and genotyping of Human Papillomvirus in attendees at venereology clinics, Sri Lanka
9.	Detection of the incidence of adenoviraemia among renal transplant recipients and its association with clinical disease
10.	Lifestyle modification intervention to address selected cardiovascular risk factors in overweight and obese women aged 35-44 years in Medical
11.	Effectiveness of a mobile phone-based nutrition counseling and lifestyle modification intervention for reducing cardiovascular risks in adults in the community: Investigation of outcomes of a Randomized Controlled Trial
12.	Chromoblastomycosis in Sri Lanka; causative agents and in vitro susceptibility test results
13.	The association between parvovirus B19 infection and persistent anaemia in renal transplant recipients in Colombo district, Sri Lanka.
14.	Diagnostic value of sputum Gram's stain and comparison of semi quantitative and quantitative culture methods in patients treated at Central Chest Clinic.
15.	Associated factors in predicting disease severity in leptospirosis
16.	Prevalence of concomitant infections of leptospirosis and dengue in selected hospitals in Western province
17.	Evaluation of Fibrosis and Steatosis by Transient Elastrography in Ultrasound proven Non-Alcoholic Fatty Liver Patients (NAFLD) in Sri Lanka
18.	Evaluation of diagnostic entities of post Tuberculosis pulmonary impairment, prevalence and risk factors in patients treated for pulmonary Tuberculosis in Colombo, Sri Lanka
19.	Prevalence of Escherichia coli O157 in beef and beef containing products in selected markets in Western Province in Sri Lanka.
20.	Synergistic antibacterial and anti-dermatophytic effects at different concentrations of *Senna alata* leaves and*Curcuma longa* rhizomes.

NARA

No	Project Title
1.	Assessment and monitoring of marine finfish fishery resources in Sri Lanka
2.	Assessment and monitoring of export oriented marine non-finfish fishery resources in Sri Lanka
3.	Bio-physical & socio-economic monitoring of the impacts due to coral bleaching and anthropogenic activities at selected sites
4.	Conservation of marine mammals and sea turtles
5.	"Sri Lanka – Norway Bilateral project" to improve the management of fish resources of Sri Lanka
6.	Marine museum upgrade and skeleton preparation
7.	Study on Production Cost of Marine Fisheries in Sri Lanka
8.	Value chain analysis and development of Giant Fresh water prawns, Lobster, Crab and Clam Fisheries in Sri Lanka
9.	Application of Indigenous Knowledge for fisheries Management
10.	Maintain of the Fisheries Information Centre (FIC)
11.	Community Welfare and Skills development of fishers
12.	Development deployment of Fish Aggregating Devices (FADs), Floating buoys and Fish Enhancing Devices (Submerge buoys) to enhance the fish production in coastal water
13.	Habitat enhancement for "big fin reef squids" at their own breeding grounds and culturing of big fin reef squids at captive condition
14.	Creating Fishing Gear models and making videos on fishing gear operation in the real world
15.	Mapping of ocean circulation and assessment of ocean dynamics (Research Vessel)
16.	Ocean observation and Forecast
17.	Oceanographic data base development
18.	Assessment of climate change and anthropogenic impacts on the ocean environment
19.	Introduction of feed for Tilapia culture

20.	Evaluation of formulated feeds developed for Asian Sea bass through community-based Sea bass farming in lagoon floating net cages
21.	Improvement of feed development technology for ornamental fish production- Panapitiya Regional Research Center.
22.	Effects of brewers yeast (*Saccaromyces cerevisae*) and Sargassum sp. On growth of Sea cucumber (*Holothuria scabra*) juveniles
23.	Use of Chitosan nano particles as an immunostimulant in tiger shrimp (*Peneous monodon)* feeds to enhance cell activity and disease resistance to resist viral diseases
24.	Development of marine fish breeding technology -Culture of seahorse in lagoon cages & Alteration of life span of fire shrimps
25.	Introduction of endemic *Pethia melanomaculata* (Tic tac barb) to ornamental fish industry through proper technology development.
26.	Biofloc Technology as an Integral Approach to Enhance Production and Ecological Performance ornamental fish culture
27.	Development of breeding techniques for selected fresh water ornamental fish using existing facilities at RRC Rekawa.
28.	Efficiency of hormones on spawning characteristics of selected exotic fish species in family *Cyprinidae* and maintenance of existing ornamental fish breeding facility
29.	Biotechnological applications on aquatic plants and seaweed industries
30.	Study of the optimum conditions for grow out farming of Sea Cucumber, (*Holothuria scabra*)
31.	Establishment of gene bank for *Kapphaphycus* & *Euchema* varieties suitable for culture in Sri Lanka and culture of other potential seaweeds
32.	Improving spat collection methods for commercial scale oyster farming and experimental reef restoration for enhance the spat availability
33.	Study on the potential for commercial use of naturally abundant oyster (*Crassostreasp*.) in Negombo estuary
34.	Investigation of possible viruses infections in shrimps and strain variation studies of WSSV related to dissemination routes
35.	Exploration on frequently recorded white spot disease out breaks and survey on OIE listed viral infections I in Sri Lanka
36.	Study on the evaluation of effectiveness of the stockings in selected perennial reservoirs in Rathnapura, Kurunegala and Puttalam districts.

37.	Establishment of community based mini hatchery to produce high quality seed production at Kattakaduwa Perennial reservoir in Hambanthota district
38.	National Charting Program
39.	Accuracy Analysis of GPS Aided geo augmented navigation (GAGAN) for inland and offshore surveying Applications
40.	Genotoxicity Screening of selected Reservoirs and Drinking Water Wells Located in the North Central Province (NCP) of Sri Lanka using Plant and Fish Based Bioassays.
41.	Behavioral impact of toxic material & pollutant and development of possible methodologies and treatment technologies to improve inland water resources including river basins (Benthara river)
42.	Investigation of causes for emergency incidents such as oil spills, algal blooms and fish mortalities (emergency studies)
43.	Assessment of current water pollution status and accumulation of heavy metals in selected edible fish species in Bolgoda Lake
44.	Comprehensive study on impacts of intensive shrimp farming on Mundel Lake and its surroundings
45.	Assessment of marine litter in the Southern and North Western Coast of Sri Lanka.
46.	Assessment and knowledge-dissemination on quality of fish, water, ice and environmental samples in boats, Central Fish Market and retail places
47.	Investigation of incidences of histamine forming bacteria in chilled Yellow fin tuna (*Thunus allbacares*) in export fishery industry
48.	Sanitary survey and assurance of safety of edible bivalve mollusks
49.	The production of Vitamin B-12 by Marine organisms
50.	Value Added Aquatic Products
51.	Evaluation of Bio-active Potential of Selected Sri Lankan Marine Algae

NBRO

No	Project Title
1.	Determination of regional and local rainfall thresholds for landslides in Sri Lanka
2.	Application of UAVs & fast image processing techniques in rock fall monitoring
3.	Development of geotechnical guidelines for high-rise buildings

4.	Designing a transitional shelter for disaster-affected communities
5.	Developing resilient construction manuals (Continuation)
6.	Constructing disaster resilient model houses:
7.	Preparation of Technical Guidelines for Building Demolition work in Sri Lanka
8.	Development of cost-effective green masonry products using textile waste
9.	Development of guideline for selection of materials and products for construction industry
10.	Development of alternative fibers to asbestos fibers for roofing materials
11.	Systematic diagnostic assessment of chemical disaster risk in Sri Lanka
12.	Analyzing the effect of meteorological, environmental and anthropogenic factors attributed to drought severity and sector-based water stress in Anuradhapura District
13.	Application of ecosystem resilience approach to analyze water resource health of Pinga Oya watershed
14.	Establishment of heat index values for the identification of hotspots (A case study in Colombo urban area)
15.	Short-Term Research Project: Comparative assessment of particulate matter concentration and air quality index in selected urban areas (A case study in Colombo)

NERDC

No	Project Title
1.	Engineering
2.	Paste making machine
3.	Gully polishing machine
4.	Data acquisition module
5.	Smark park monitoring system
6.	Automated hopper machine
7.	Portable milking machine
8.	Yoghurt filling machine
9.	Pneumatic transfer of medical samples

10.	Light weight roofing tile
11.	Fly ash for block making
12.	Coir braiding machine
13.	Advancement of NERDC cremator
14.	Aquatic weeding machine

NIFS

1.	***Australia***	• Queensland University of Technology • University of New England, Australia • University of Sydney, Australia
2.	***Germany***	• Georg-August-Universität Göttingen, Göttingen,
3.	***Italy***	• University of Parma
4.	***Japan***	• Shizuoka University, Japan • Toyota Institute of Technology, Japan
5.	***Norway***	• Western Norway University
6.	***Pakistan***	• University of Agriculture, Pakistan • National University of Medical Sciences Rawalpindi, Pakistan
7.	***Sri Lanka*** -	• Open University of Sri Lanka, Nawala • Sabaragamuwa University of Sri Lanka • South Eastern University of Sri Lanka • University of Colombo • University of Jaffna • University of Kelaniya, • University of Peradeniya, • University of Rajarata • University of Ruhuna • University of Sri Jayawardenapura • University of Uva Wellassa • University of Wayamba • Atomic Energy Board, Sri Lanka • Coconut Research Institute, Lunuwila

		• Irrigation management division, Irrigation Department • Mahaweli Authority of Sri Lanka • National Herbarium, Peradeniya • NRMC, Department of Agriculture, Peradeniya • Respiratory disease treatment unit, Teaching hospital, Kandy • RRDI, Batalagoda
8.	***Sweden***	• Chalmers University
9.	***United Kingdom***	• University of the West of Scotland • Natural History Museum, London • Buckingham Centre for Astrobiology, Buckingham
10.	***United State of America***	• Georgia State University, USA • California Polytechnic State University, San Luis Obispo

NIPM-IPHT

N0	**Project Title**
1.	Evaluation of appropriate low temperature storage conditions for locally available economically important vegetable crops
2.	Preharvest and Postharvest disease management of green chilies using rice husk silicon as an alternative strategy for synthetic fungicides
3.	Ensuring the safety of edible oil used in food Industry by developing methodologies to detect and quantify polymer migration from plastic bottles to edible oils
4.	Evaluation of the effectiveness of freeze drying and vacuum packing technology for preservation of fresh fruits (Papaya, Guava, Pineapple)
5.	Use of Potential Biological Control Agents in Controlling Post Harvest Diseases of Mango with special reference to Anthracnose

6.	Prebiotic potential of resistant starches and dietary fibers of Sri Lankan traditional rice varieties and its application in food industry
7.	Influence of pretreatments on post-harvest quality and shelf life extension of Mango cv.Karuthakolomban
8.	Development of a food additive to preserve food by incorporating of oil extractions of nutmeg (*Myristica Sp)* and cinnamon (*Cinnamon Zeylanicum)*
9.	Design & construction of a tunnel type forced air cooler for cooling or fresh Mango
10.	Development of Value added Legume Based granular bar boosted with antioxidant activity
11.	Process improvement for freeze preservation of vegetables (Carrots, Beans, Beet-root)
12.	Feasibility analysis to use geospatial tools to improve the mango supply chain via enhancing the traceability : A case study based on Omaragolla mango collector group
13.	Identification and development of strategies for enhanced quality and postharvest life of lotus
14.	Design and Development of an Image Processing Based low Cost Fruit Maturity Identification Instrument
15.	Effect of Citronella grass leaf extracts on degree of insect infestation and storage quality of the stored maize in Sri Lanka

NPQS

Project Title
1. Molecular detection of the causative agent of the soft rot of *Aglaonemamaria*
2. Screening of imported seed potato to detect and characterize *Ralstoniasolanacearum* for quarantine purposes
3. Evaluation of Quality of Imported Seed Potatoes with Respect to Plant Pathogens of Quarantine Significance.
4. Development of standards for VAPORMATE® and Liquid Phosphine for quarantine and non-quarantine fumigation of agriculture commodities, and storage faciities for the control of pests
5. Tryclopyr for Devitalizating Dracaena sanderiana and Cordyline spp. Stem Cutting for Phytosanitary Purpose

NRC

No	Project Title
1.	Copper zinc tin sulfide (CZTS) Photovoltaic – Thermoelectric hybrid system for the fabrication of efficient solar energy conversion devices
2.	Fabrication and analysis of super capacitors with low cost composite hybrid electrodes to meet the future energy challenge
3.	Island wide Study on Scrub Typhus genotypes, their clinical features Biochemical markers of severity and Transmitting vector species
4.	Genetic diversity and cultivar development of Dendrobiums integrating classical and molecular biological tools
5.	Investigation of aetiology, disease development and management of rough bark disease of cinnamon (Cinnamomum zeylanicum Blume)
6.	Transdermal drug delivery via smart textiles: Development of new formulations for the controlled release of natural compounds to prevent cancer
7.	Design, analysis, and optimization of next generation fiber optic national backbone network
8.	Foetal haemoglobin induction as a treatment for β-thalassaemia
9.	Production of Mosquito Repellents using Lesser-Known, Under-Utilized Volatile Oil Producing Plant Species
10.	Effectiveness of an intervention to introduce reading skills to school children with features of dyslexia in the Gampaha District in Sri Lanka; a randomized clinical trial
11.	Impact of Increasing Renewable Energy Developments on the Reliability of Power Generating Systems
12.	Development of a Soft Robot Gripper with Inbuilt Sensors for Deformable Object Grasping and Tactile Feedback
13.	Cardioprotective effect of three medicinal plants against doxorubicin induced cardiotoxicity in Wistar rats and in neonatal ventricular cardiomyocytes
14.	Novel and Innovative Strategies to control Anopheles stephensi and other malaria vectors for prevention of reintroduction of malaria in Sri Lanka
15.	"Absorption of selected pesticide residues during cooking by curry leaves available in Sri Lanka and its impact on the carotenoid compositional variation in curry leaves
16.	Understanding exposure levels of volatile organic compounds and fine particulate matter while commuting in Kandy city
17.	Modeling and description of compact astrophysical objects using Einstein's field equations
18.	Isolation and identification of environmental Burkholderia pseudomallei and comparative analysis of major virulent associated genes from clinical isolates of infected Sri Lankan Melioidosis patient
19.	Developing and validating a speech sound (articulation and phonology) assessment for Sri Lankan Tamil-speaking children aged 3 to 6 years
20.	Development of a phototrophic-heterotrophic biofilm/mat for the detoxification and removal of Chromium in waste water
21.	Identification of drought tolerant coconut mother palms through phenotypic, physiological and gene expression studies

22.	Effect of priming of rubber (Hevea brasiliensis) plants with some natural or chemical compounds on growth and abiotic stress alleviation under sub-optimal climatic conditions in Ampara District of Sri Lanka
23.	In-silico mining for resistance gene analogs and identification of genetic resources for blast disease resistance in the local finger millet germplasm
24.	Extraction, purification and chemical characterization of inulin-type fructans from three Asparagus species (A. falcatus, A. racemosus, and A. officinalis) grown in Sri Lanka, and their utilization as potential prebiotic ingredients in dairy products
25.	Use of Artemisia vulgaris (L) as an eco-friendly and economically-viable component in integrated management of weeds, insect and mite pests and nuisance pests in tea fields of Sri Lanka
26.	Microbial metabolites - a source for development of eco-friendly new weedicides
27.	Development of eco-friendly integrated weed management system for rice farming
28.	Investigations on eco-friendly cultural , physical and allelopathic weed management strategies for tea cultivation as alternatives for synthetic herbicides

NRMC

	Project Title
1.	Issuing of long-term climate forecasts at regular intervals
2.	Development of weather based alert system as a decision-making tool for crop management
3.	Inter seasonal variability of the rainfall pattern in the Dry zone of Sri Lanka with the influence of El Nino southern oscillation
4.	Assessment of extreme climate change trends of Sri Lanka
5.	Development of climate resilient village tank system
6.	Mapping Soil Organic Carbon distribution in Sri Lanka: A GIS Based Approach
7.	Identification of drought and high temperature prone agriculture areas and characterize spatial and seasonal agro-ecological environment for adaptive measures
8.	Identification of suitable paddy lands within major irrigation schemes for seasonal crop diversification
9.	Updating erosivity map of Sri Lanka with response to climate change
10.	Farmers' perceptions towards climate change effect on fruit cultivation in some districts with different agro-ecologies in Sri Lanka: Moneragala district
11.	Web GIS Portal for Agriculture Information – NSDI Agriculture user case
12.	Assessment of Atmospheric Nitrogen Pollution Sources, Impacts on Environmental Sustainability, Human Health and Remedial Measures in Three Unique Pollution Regions in Sri Lanka
13.	Comparative assessment of soil erosion, soil moisture and crop performance in contour soil bund system introduced as an adaptation measure to climate change impacts in Anuradhapura district with other land uses
14.	Identification of sources and transport of agro-contaminants in hilly agricultural watersheds in the declared conservation area in Sri Lanka
15.	Establishment of soil conservation productivity enhancement site in conservation area
16.	Monitoring water quality of major streams in central highlands in Sri Lanka to identify critical watersheds for conservation

17.	Implementation of Soil Conservation Act (SC Act)
18.	Development of Isohyetal maps for rainfall seasonal onsets and lengths as an adaptation to climate change in Sri Lanka
19.	Increasing water and soil productivity under marginalized agriculture communities living in Mahaweli River basin in Madigiriya
20.	Rainfall intensity duration frequency Studies in Kandy district

PGRC

No	Project Title
1.	Viability testing and study of storage behavior of conserved germplasm
2.	Molecular characterization of Dioscorea
3.	Study the diversity of Capsium spp. (Nai Miris)
4.	Protocol development for Cryopreservation
5.	Dioscorea micro tuberization as a tool for long term conservation & planting material production

PPS

No	Project Title
1.	Promotion of environment-friendly pest management practices

PRI

No	Project Title
1.	Modification of product formulation of fruit pulp based ready to serve drink existing in the market towards better quality
2.	Extracting pigments from palmyrah fruit pulp for the production of food additives, nutracutical products and natural colorants for cosmetics, textiles and handicrafts.
3.	Formulation and standardization of a moisturizing, skin complexion improving facial gel /cream using palmyrah fruit pulp
4.	Nutritional comparison of fresh and preserved young fruit kernel
5.	Preparation and shelf-life evaluation of different flavored crude sugar

6.	Preservation and development of desirable natural characteristics of palmyra which are important for the industry
7.	Bio-ethanol production from molasses

RRDI

Project Title

1. Development of new rice variety for 4 months
2. Evaluation of Yield potential of newly bred promising lines against the recommended varieties under Preliminary Yield Trial
3. Evaluation of Yield potential of newly bred prommising lines against the recommended varieties under Major Yield Trial
4. Purity maintenance and multiplication of elite lines
5. Breeder seed production Varieties: Bg450, Bg 403, Bg 406, Bg 379-2
6. Development of new rice varieties tolerant to salinity
7. Development of high yielding 3.5 months age rice varieties for favorable environments
8. Development of heat Tolerant rice varieties for Development of Cold Tolerance rice varieties
9. Breeder seed production (Bg 352, Bg 357, Bg 358, Bg 359, Bg 360, Bg 366, Bg 369, Bg 370, Bg 94-1, Bg 374)
10. Multiplication of 3.5 months age rice promising lines (Bg 08-1407, Bg 11-802, Bg 14-567)
11. Development of high yielding 3 months age rice varieties for favorable environments
12. Development of rice varieties with low moisture stress tolerance
13. Development of drought escaping short age rice varieties (NRC project)
14. Breeder seed production (Bg 300, Bg 310)
15. 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)
16. Development of 2 ½ month (ultra-short age) rice varieties
17. Breeder seed production
18. Evaluation of Yield potential of promising lines a- Preliminary Yield Trial (PYT) b- Major Yield Trial (MYT)
19. Purity maintenance and multiplication of elite lines
20. Development of BPH resistant rice varieties through Marker Assisted Breeding program
21. Development of new improved quality rice varieties with acceptable yield
22. Evaluation of new elite rice lines in preliminary yield trial (PYT)
23. Evaluation of promising rice lines in major yield trial (MYT)
24. Development of early drooping rice variety for integrated weed managemen
25. Multiplication and maintaining the genetic purity of promising rice lines (7 promising lines)

26. Evaluation of parental materials belongs to all age categories
27. Development of new hybrids through heterosis breeding
28. Evaluation of crosses combinations in test cross nursery
29. Preliminary yield trial (PYT)-Exotic Hybrids
30. .F_1 seed production of promising hybrid
31. Nuclear seed production
32. Small scale seed production
33. Preliminary yield trial (PYT)-Local inbreed restorer line
34. Development of new male sterile rice lines via wide hybridization
35. Screening of new restorer lines
36. Screening of new lines for cold tolerance
37. Germplasm multiplication and conservation
38. Purification of selected traditional rice cultivars
39. Development of quality rice varieties through mutation
40. Incorporation of AG1 gene into Bg 366 through MAS
41. Incorporation of Sub1 gene into popular varieties (Bg 455, Bg 379-2, Bg 360, Bg 358)
42. Development of Drought tolerant introgression lines of popular two varieties
43. Development of drought tolerant / escape lines
44. Development of BPH and BLB resistant rice lines
45. Calli mediated mutation breeding using chemical mutagen
46. Pyramiding of BLB and Blast resistant genes in rice
47. Development of grain quality by grain shape and incorporation of fragrance in rice
48. Development of Phosphorus deficiency tolerant rice varieties
49. Identification and confirmation of Gall midge resistant rice varieties/ lines available in Sri Lanka
50. Maker Assistant breeding of Gall midge resistant rice line/ variety
51. Testing of promising rice lines in low county intermediate zone - (NCRVT)
52. Adaptability testing of promising rice lines (VAT / LSVAT)
53. Multiplication of abiotic stress tolerant lines
54. Adaptability testing of new cultural / farming practices for rice cultivation in Polonnaruwa district
55. Multiplication of cold tolerant lines/varieties
56. Evaluation of cold tolerant rice varieties for yield and agronomic characters
57. Screening of selected rice lines for drought tolerance
58. Screening of rice varieties and lines for heat tolerance
59. Evaluation of selected rice varieties and management options for mechanical transplanting (4 trials at research & farmer fields)
60. Effect of seeding rate for growth and yield of mechanical transplanted rice
61. Evaluation of selected varieties and management options for rice germinated in standing water condition
62. Evaluation of weed management options for rice germinated in standing water condition
63. Screening of rice varieties for ability to germinate in standing water condition
64. Long term effect of P application on soil P content and grain yield of rice

65. Long term effect of application of organic manure and chemical fertilizer to rice fields
66. Nitrogen response of elite breeding lines
67. Long term effect of K fertilizer on soil and plant K content in rice cultivation
68. Maintenance of rice fields without application of chemical fertilizer or organic manure
69. Development of site-specific fertilizer management systems for sustainable crop production (FAO Project)
70. 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)
71. 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)
72. Fertilizer recommendation for ultra-short aged rice varieties
73. Study the nutrient availability in soil and plant with different moisture/water level in paddy fields
74. Evaluation of new fertilizer materials issued by fertilizer testing committee on paddy cultivation for field trials
75. Evaluation of new fertilizer materials issued by fertilizer testing committee on paddy cultivation for field trials
76. Need based use of fertilizer inputs in the food crop sector
77. Evaluation of bio-film bio fertilizer on growth and yield of rice
78. Study the performance of selected popular traditional rice varieties under organic condition
79. Study the effect of glyricidia on weed management of rice under organic condition
80. Effect of temporal variation of climatic condition on irrigated rice cultivation
81. Effect of the temporal variation of climatic condition on rainfed rice cultivation
82. Effect of the application of AWD during flowering of rice
83. Effect of soil moisture at different tension levels during vegetation period in rice cultivation
84. Preparation of soil P map for Polonnaruwa, Anuradhapura and Kurunegala districts
85. Study of Seasonal Variation of Paddy bug (*Leptocorisaortorius*)
86. Development of a management system for rice field rats in Sri Lanka based on their diversity, ecology, reproductive behavior and societal impact
87. Evaluation of effectiveness of insecticides against major rice pests
88. Evaluation of pest incidence of different establishment methods
89. Study of identification of relationship between whorl maggot damage and white spikelet occurring with relation to climatic variations
90. Development of *Bacillus thuringiensis* (Bt) Microbial Pesticide to control Major Rice pests
91. Evaluation of chemical constituents present in volatile compounds isolated from rice for egg laying behavior of paddy bugs.
92. Re-evaluation of already recommended rice varieties and traditional rice varieties for BPH

93. Evaluation of silica containing products as nutrient cum plant-resistance inducers for thrips, Leaf Folder and BPH in rice.

94. Screening of NCVT rice lines / breeding lines for resistance to Brown plant hopper (BPH)

95. Screening of NCRVT rice lines / breeding lines for resistance to Rice Gall Midge (RGM)

96. Impact of crop/ pest management practices adopted by farmers in major rice growing areas in Sri Lanka on activity of egg parasites of BPH

97. Testing of Pheromones traps for rice stem borer and leaf folder

98. Identification of insecticide resistance status of BPH found in Ampara Dist. against insecticides belongs to neonicotinoid groups

99. Utilization of Kairomones from mature-rice plants for mass trapping of paddy bugs

100. Investigations on the factors relevant to the recent Rice Stem Borer outbreak in Polonnaruwa district during 2018 to initiate an early warning system

101. Study on the level of resistance of variety Bg 310 for Rice gall midge

102. Investigation of pathotype diversity of the bacterial leaf blight pathogen *Xanthomonas oryzae pv oryzae* in Sri Lanka

103. Investigation of fungicide for grain discoloration

104. Screening of rice breeding lines for bacterial blight resistance

105. Screening of rice breeding for blast resistancc

106. Screening of new source of fungicide against rice blast

107. Screening of new source of fungicide against rice sheath blight

108. Isolation & identification of rice blast diseases suppressing bio control agent from the soil

109. Identification of seed borne fungi and its effect on grain quality of rice in Kurunegala district

110. National coordinated rice herbicide testing program

111. Re-evaluation of effectiveness of recommended herbicides for rice cultivation

112. Evaluation of weed suppressive ability of new promising rice lines

113. Evaluation of Phyto-toxicity effect of recommended herbicides on different rice varieties

114. Evaluation of bio-efficacy efficacy of different rates of Bispyribac sodium herbicide (Nominee & Kensolo)

115. Study on effect of phyto-toxicity of Hebrides on yields of ultra-shortage rice varieties

116. Weed management through soil seed bank depletion technique by alternate poly mulching

117. Evaluation of weed control efficacy of different herbicides under rain-fed condition

118. Evaluation of different sprayers for herbicide spraying in rice cultivation

119. Evaluation of nutraceutical and health properties of popular traditional and improved rice varieties

120. Evaluation of grain quality characteristics of different breeding materials under low moisture and normal irrigated environmental condition

121. Effect of vacuum packaging and storage condition on rain characteristics of selected rice varieties
122. Evaluation of grain quality characteristics of advanced breeding material and NCRVT entries
123. Evaluation, multiplication and selection of exotic germplasm (imported from Bangladesh)
124. Improvement of high yielding rice varieties for LCWZ through conventional breeding technique
125. Improvement of rice varieties for submergence and iron toxic conditions
126. Testing Yield Potential of Promising rice lines
127. Breeder seed production of recommended Bw rice varieties
128. Seed Purification of Promising lines
129. Seed Multiplication of Promising lines
130. Supply of quality seeds of selected traditional rice varieties
131. The sixteen International Rained Rice Observational Nursery (IRLON 2018)
132. Identification of suitable Bw rice varieties for machinery transplanting
133. National coordinated rice varietal test (NCRVT)
134. Varietal adaptability testing (VAT)
135. Testing nitrogen response of promising Bw rice line
136. evaluation of different fertilizer products for rice cultivation in LCWZ
137. long term effect of different nutrient management system on grain yield of rice
138. fertilizer recommendation for ultra-short aged rice varieties
139. response of rice plant to applied Sulphur
140. study the effect of Zn fertilization method on grain yield and grain Zn content of rice
141. Development of foliar fertilizer from straw extract for rice cultivation
142. evaluation of soil & plant test kit fertilizer recommendation
143. evaluation of different fertilizer products in pot experiments
144. calibration studies on soil phosphorus & soil potassium
145. Evaluation of silica containing products as nutrient cum plant resistance inducers for thrips
146. Screening of NCRVT rice lines for BPH
147. Honey dew test for BPH
148. Screening of NCRVT rice lines for gall midge
149. screening of breeding lines for BPH
150. screening of INGER for BPH
151. Screening of traditional rice varieties for rice sheath mite
152. Study on grain discoloration of some important rice varieties and their effect on seed germination and seedling vigor
153. Screening of breeding lines, NCRVT lines, INGER for BLB
154. Screening of NCVT rice lines / varieties, promising breeding lines & INGER for blast disease
155. Evaluation of silica containing products as nutrient cum plant resistance inducers for brown spot disease

156. Study the effect of water management and appropriate time of power weeder application on weed control in machinery transplanted rice

157. Evaluation of anaerobic germination trait incorporated rice lines to determine the germination and seedling development under field submerged condition

158. National coordinated herbicide test (NCHST)

159. Evaluation of different rice lines/ germplasm for upland cultivation

160. Identification of effective weed control method for upland rice cultivation (Sorjan beds)

161. Generation of a fertilizer recommendation for ultra-shortage rice verities

162. Evaluation of promising rice lines under NCRVT program

163. Evaluation of promising rice lines under VAT program

164. Production of commercial seeds of Bg455, Bw372, Bw367, Suwdal and Bg38.

165. Screening of promising rice lines for submergence and saline condition (Collaborative study with Labuduwa)

166. Response of Rice (Oryza sativa. L) to different methods of Zn application in low country dry zone in Sri Lanka

167. The response of different rice verities to different N levels under direct sowing

168. Development of new fertilizer recommendation for ultra-short age rice varieties

169. NCRVT trial

170. VAT trial

171. Development of improved rice varieties through Conventional breeding methods

172. Evaluation of yield potential of promising rice breeding lines

173. Breeder seed production

174. Multiplication of promising breeding lines

175. *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

176. Screening of MYT and PYT trials for grain quality attributes

177. Response of rice and weeds to submergence during germination and early growth

178. Response of rice genotypes to weed competition in wet DSR

179. Assessment of status of weed management in Hambantota district.

180. Evaluation of herbicide resistant *Cyperusdifformis* and *Cyperusirri*population in DSR in Hambantota district

181. Evaluation of different sprayers for herbicides application

182. Screening of popular samba type rice varieties against to phytotoxicity of available herbicides.

183. Rice variety improvement for high potential rice lands of LCWZ

184. Improvement of rice varieties for the salinity affected flood prone soil conditions of Low Country Wet Zone

185. Development of thrips tolerant rice varieties

186. Identification of suitable traditional rice varieties, documentation of farmers knowledge and strengthening of seed flow network of traditional rice in Low Country Wet Zone

187. Breeder seed production

188. 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.)

189. Pest forecasting trial for rice sheath mite

190. Evaluation of IRRI Rice varieties and lines for BLB

191. Screening of advance Breeding lines for the resistance of Brown spot

192. National Coordinated Herbicide Screening (NCHST) Trial for wet-seeded rice

193. Identification of better performing, BLB tolerant lines through yield testing from INGER nurseries

194. Testing of promising rice lines in low county dry zone - (NCRVT)

195. Testing of yield performance of promising rice lines

196. Effect of BPH attack in different stages in different varieties of rice in Ampara District. To find out the influence of varieties and planting stages on the BPH incidence

197. Bio-efficacy evaluation experiments of candidate herbicides to evaluate the bio-efficacy of new herbicide in wet seeded rice

198. Field validation of improved IWMP by combining weed competitive cultivars To Field Validate Improved IWMP by Combining Weed Competitive Cultivars

199. Weedy rice problems and solutions for its management in Ampara District To develop awareness campaign to manage weedy rice problem in rice cultivation.

200. Evaluation of performance of short- and long-term Rice Varieties In-Order to Avoid Drought Period To evaluate growth and the yield parameters of short duration rice variety using three irrigation intervals in- order to avoid drought condition

201. Adaptation testing of promising drought tolerant lines to evaluate the adaptability of the selected promising lines in farmer's Multiplication of promising drought tolerant lines to maintain the selected promising lines for future testing

202. Purification of local land races of rice in northern region

203. Evaluation of selected locally, collected popular rice lines for yield and the grain quality characters

204. Development of high yielding resistant to major pest & disease consumer preference to region, short-intermediate duration red rice varieties

205. Development of high yielding consumer preference to region, short duration red rice varieties for rainfed condition

206. Evaluation on different spacing on growth and yield performance of rice by using transplanter machine

207. Evaluation Experiments of Different Herbicides Application Control Weeds in Rice Cultivation.

208. Effect of Different Rice Establishments Methods

209. Testing of promising rice lines in low county intermediate zone - (NCRVT)

210. Comparing the Different Organic Fertilizer with Inorganic Fertilizer

211. Seed production

212. Effect of Different Mulching with Alternate Wetting and Drying

213. Selecting suitable high yield promising rice varieties in northern region

214. Testing the Varietal adaptability in dry zone (VAT)

215. Evaluation on different depths of planting of growth and yield performance of rice using transplanter.

216. Influence of Organic Pesticides on Growth and Yield of Selected Rice Varieties in Northern Region

217. Bio-Efficacy Evaluation Experiment of Candidate Herbicides

218. Influence of *Azolla* in Rice Growth and Yield

219. Effect of Seedling Age on Growth and Yield Responses of Machine Transplanted Rice.

220. Effect of different Weed Control Methods in Machine transplanted rice

221. Application of Special Fertilizer Products for Pot Cultivation in rice

222. Identification of Suitable Weed Control Methods in Dry Drilled Seeded Rice

RRI

No	Project Title
1.	Establishment of environmentally friendly, economically viable slow-release fertilizer techniques to improve crop performances and soil quality of rubber plantation in Sri Lanka. Enhancing soil fertilizer in degraded rubber lands by combine one of agro management practices such as inorganic fertilizer, bio fertilizer, cover cropping and mulching with organics.
2.	Use of appropriate statistical methods to improve interpretability of results obtained from research trials
3.	Improving the knowledge base on climate, climate change & variability for better decision making in rubber growing areas
4.	Improvement of nursery and propagation techniques, field establishment and immature upkeep
5.	Testing of different harvesting systems for sustainable utilization of bark and productivity improvement
6.	Intercropping diverse crop species with rubber for land productivity improvement, additional income generation and environmental sustainability
7.	Research, development and commercial introduction of low intensity harvesting strategies
8.	Research and development on biochemical and physiological aspects to improve the sustainability of rubber farming
9.	1.Screening of chemicals
10.	2. Biology of pets
11.	3. Screening of clones

12.	4. Biological controlling
13.	5. Surveillance
14.	6. Miscellanies
15.	7. Advisory
16.	8.Training

SCS

No	Project Title
1.	Effect on seed film coating on seed quality parameters
2.	Construction of epidemiology interchange system for the management of migratory pest and diseases.

SLCARP

Project Title
1. Identification and confirmation of phytoplasma diseases and their host range in cultivated crops 2. Development of promising pomegranate lines through in vitro mutation induction 3. Optimization of Micro propagation protocol for DOA recommended Banana variety "Agra" 4. Development of early selection criteria for screening tea germplasm for high black and green tea quality using a combination of biochemical and molecular markers 5. Study the mechanism of host parasite interaction between root parasitic Santalum album and its preferred hosts to popularize the cultivation in Sri Lanka 6. Functional analysis of the promoter sequence regions of the rubber elongation factor gane from Hevea Brasiliensis 7. Development of a phosphate biofertilizer for improved phosphorous nutrition of rice 8. Development of early selection criteria for screening tea germplasm for high black and green tea quality using a combination of biochemical and molecular markers 9. Study the mechanism of host parasite interaction between root parasitic Santalum album and its preferred hosts to popularize the cultivation in Sri Lanka
10. Conservation and characterization of selected fruit germplasm using molecular methods for establishment of Bio-diversity garden of tropical fruits at Girandurukotte. 11. Development of Passion fruit varieties through hybridization and composite seed production. 12. Characterization of flowering behavior and floral biology of Beili (*Aegle marmelos*), Wax apple (*Syzygium samarangense*), Ceylon olive (*Elaeocarpus serratous*), Soursop (*Annona muricota*), Sapodilla (*Manilkara zapota*) for improvement of productivity and quality. 13. Improvement of grain quality attributes of rice varieties suitable for the international community 14. Development of locally adaptable Cytoplasmic Male Sterile (CMS) rice lines.

15. Rice variety selection for the salinity affected flood prone soil conditions of Low Country Wet Zone through farmer participatory approach
16. Collection, establishment, evaluation and conservation of germplasm of Betel (*Piper betle* L), Ginger (*Zingiber officinales* Roscoe) and Turmeric (*Curcuma domestica* L).
17. Development of locally adaptable Cytoplasmic Male Sterile (CMS) rice lines.
18. Rice variety selection for the salinity affected flood prone soil conditions of Low Country Wet Zone through farmer participatory approach

19. Estimating forest dieback and regenaration potentials in Montage forest at Horton Plains National Park

20. Development of sustainable plant nutrient management package for Intensive cultivation of vegetables in North Western Province.

21. Causes for low adoption rates of micro-irrigation in Jaffna and Vavuniya Districts and mitigation measures

22. Utilization of *Antigonon leptopus* as bio-fertilizer

23. Development of sustainable plant nutrient management package for Intensive cultivation of vegetables in North Western Province.

24. Improvement of the yield and quality of Banana Musa spp. Var. Millewa Suwandel by some specific management practices.

25. A study the effect of changes on annual weather in soil Carbon and Nitrogen dynamics in Black Pepper (*Piper nigrum L.*) cultivations

26. Development of detailed spatial inventory of soil phosphate and organic carbon stocks at sub-catchment scale.

27. Development of Organic protocols for commercial scale Greenhouse vegetable production.

28. Regulation of fruit set and post-harvest life and investigation of the variability of bioactive compounds in edible *Annona muricata* L. accessions found in Sri Lanka.
29. Studies on fruit phenology, pre-harvest foliar treatments on fruit quality and enhancement of postharvest life of Lime (*Citrus aurantiflolia* Swingle)
30. Descaling of a Compartment Separator
31. Development of Value added products using waste betel (Piper betel) leaves

32. Diversity of Ralstonia solanacea rum species complex causing bacterial wilt in solanaceous vegetable crops in Sri Lanka
33. Development of Intergrated diesease management package using cultural practices, Biological control agents and safe chemicals for controlling botrytis blight of lettuce and tomato in polytunnels
34. Development of *Metarhizium anisopliae* as a biopesicide to manage Shoot and Fruit Borer - *Leucinodes orbonalis* (Guen.) in Brinjal (*Solanum melongena* L.)
35. Role of allelochemicals in rice (*Oryza sativa*) resposible for reproductive maturity of Paddy Bug, *Leptocorsia oratorius* (hemiptera: alydidae)
36. Appropriate technology development for the management of Onion nematode by using organic amendments in the Jaffna District.

SLINTEC

No	Project Title
1.	Graphene Oxide and Graphene from Sri Lankan Vein Graphite
2.	Linamarin (cassava) based Nutraceutical for Prophylactic treatment of cancer Plant based Nutraceutical for Prophylactic treatment of internal clotting (Stroke and Myocardial infarction) -(Anticogulant)
3.	Development of antiviral drugs to inhibit the dengue virus entry into target cells
4.	Extraction of Titanium from earth resources

SRI

No	Project Title
1.	crop improvement
2.	crop and resource management
3.	crop nutrition
4.	crop protection
5.	farm mechanization
6.	processing and product development

TRI

No	Project Title
1.	A 1.1 Development of tea cultivars for up country (2016-2033)
2.	A 1.4Screening lines for resistance / tolerance to the root lesion nematode (P. loosi) for UC regions (2017-2019)
3.	A 1.5 Screening lines for response to applied nutrients (2008-2018)
4.	A2.1 Development of tea cultivars for mid country wet zone(2016-2033)
5.	A 2.2 Screening lines for resistance to BB & stem canker (Long term)
6.	A 2.4 Screening lines for resistance/tolerance to the root lesion and burrowing nematodes for MC regions (2017-2019)
7.	A 2.8 Screening of 5000 series tea cultivar for drought under MW (Long term)
8.	A3.1 Development of tea cultivars for mid country semi-dry zone (Uva)(2016-2033)
9.	A 3.4Screening lines for resistance/tolerance to the root lesion and burrowing nematodes for Uva (2017-2019)
10.	A 3.8 Screening of 5000 series tea cultivar for drought under Uva (Long term)
11.	A4.1 Development of tea cultivars for low country(2016-2033)

12.	A 4.3 Screening lines (5000 series) for resistance/susceptibility to LCLWT & SHB for Low Country (2017-2019)
13.	A 4.4 Screening lines for resistance/tolerance to root lesion and burrowing nematodes for LC regions (2017-2019)
14.	A 4.7 Screening of 5000 series tea cultivar for drought under LW (Long term)
15.	A51 Development of a holistic approach in germplasm conservation, characterization and evaluation to enhance its rational utilization in tea breeding program (2016-2033)
16.	A52 Development (or screening) of tea cultivars specifically suitable for small growers who cannot afford to use high input or modern agricultural practices(2016-2033)
17.	D/BREED Routine divisional activities (Longterm)
18.	B 100 Establishment of anatomical, biochemical, molecular & physiological basis of major pests SHB, LCLWT (2015-2019)
19.	Thrust A15. Development of regional (AERs) &/or site-specific fertilizer/ dolomite recommendations
20.	A15.1 Estimating crop response to macronutrients (N, K, Mg, S & P) at AER level. (2015-2018)
21.	A15.2 Estimating crop response to micro-nutrients (Zn, B, Mn, Mo etc.) at AER level (2013-2018)
22.	A 15.3 Development of methods for formulation of bio-organic and mineral or compound fertilizers suitable for tea (2015-2020)
23.	A 15.4 Establishing dolomitic limestone requirements for better growth of mature plants in different tea growing regions at series level (2018-2020)
24.	A15.5 Development of economically viable slow releasing compound fertilizer basically for nitrogen, phosphorous, potassium and magnesium
25.	A15.6 Introduction of micro nutrient fortified foliar formulation based on micro nutrient status in tea growing soils (2014-2018)
26.	A 15.7 mineralization patterns of organic materials and bio avilability of nutrients to partially replace inorganic fertilizer for tea in Sri lanka
27.	D/ SPN- Divisional activities (Long term)
28.	B 125 the survey on possible factors of contamination of Rare Earth Ellements (REES) in made tea in Sri Lanka(2018-2019)
29.	B 78 Studying root system and architectures with nutrient acquisition with root windows with a view to examine below and above ground relationships
30.	A 10.2 Evaluation of 2 new grasses, CO-3 and lemon grass in comparison with Mana & Gautemala -(2011-2025)
31.	A 34.1Evaluating growth performances and effects of identified shade tree species on tea and establishing cultural practices for them (2008-2020)
32.	A 34.3 Development of pests and diseases management strategies for shade trees different AERs
33.	A 10.3 Investigation on soil quality to validate the SQI (2014-2018)
34.	A 19.1 Evaluating cultivar performances under different irrigation systems (2013-2022)

35.	A 19.4 Evaluation of rainwater harvesting technique (2013-2022)
36.	A 10.5 Investigation on soil degradation by water erosion & conservation of tea lands in low & mid elevations (2017-2020)
37.	B 67 Investigating the compatibility of stock & scion for grafting on high quality & productivity of tea (2006-2022)
38.	A50.3 Carbon budgeting for different tea growing regions (2015-2019)
39.	A 50.4 Climate change and its affect on pest incidences (2015-2019)
40.	A 50.5 Analysis of climate change, identifying vulnerable tea growing regions & seasonal weather forecasting for different tea growing regions (2013-2018)
41.	A50.6 Use of Omic approaches towards the development of cultivars resistant to biotic and abiotic stresses (2014-2019)
42.	B 131 Approaches to reduce deleterious effects of climate change on tea
43.	C/MET (Long term)
44.	D/Agry-Activities of Agronomy Division
45.	D/Phy Physiology Divisional Activities (Long term)
46.	A 20.3 Designing of motorized tea harvesters (2014-2018)
47.	A 20.9 Mechanization of field practices (Long term)
48.	A 20.10 Mechanization of field practices (Long term)
49.	A 20.11 Mechanization of field practices(Long term)
50.	A 20.12 Mechanization of field practices (Long term)
51.	A 20.13 Development of smart spraying techniques for effective Agro-chemicals applications
52.	A 53.1 Evaluating different media and mixtures for tea nurseries
53.	A 53.6Evaluating micro irrigation systems for tea nurseries (2018-2019)
54.	A 24.1 Screening synthetic herbicides & establishing residue levels and PHIs. (Long term)
55.	A 24.3 Development of cultural and biological measures for suppressing weeds (Longterm)
56.	A24.4 Environmentally friendly aapproaches for weed control in tea plantations (2018-2021)
57.	A 22.2 Screening biological control agents for reducing SHB damage in immature and mature tea
58.	A22.6 Development of formulations of PPP for SHB control -E 402: Evaluation of quercivorol lures & multi funnel traps to reduce SHB (2018)
59.	A 54.2 Screening of new wound dressings to protect the prune cut surfaces from LCLWT (Longterm)
60.	A45.1 Introducing user friendly alternative tea propagation & soil sterilizing techniques & protected tea nursery concepts to minimize contamination & prevent dissemination of tea nematodes through planting materials (Longterm)

61.	A45.2 Evaluating methods for managing nematodes in young and mature tea (Longterm)
62.	B29 Refining techniques for sampling, laboratory & field experimentation, surveys & statistical designs for studying insect, mites & nematode (2018-2019)
63.	B 69 Identification & use of semiochemicals for reducing insect & mite pest damage (2017-2018)
64.	D Ento 1 Screening of new & alternate acaricides /insecticides /termiticides & strengthening IPM for tea pests (2018)
65.	A 22.2 Screening biological control agents for reducing SHB damage in immature and mature tea
66.	Thrust A23 Development of integrated management strategies to control major tea diseases
67.	A 23.1 Screening, evaluating & commercial formulation of soil-born antagonist for major root diseases and their promotion (2013-2020)
68.	A 23.4 Screening synthetic fungicides, Establishing MRLs & PHIs (Long term)
69.	B102 Use of plant induced resistance for controlling tea blister blight (2016-2018)
70.	B103 Investigation of epidemiology of stem diseases of tea (2016-2018)
71.	B115 Development of a Multiplex PCR diagnostic kit to identify fungal pathogens in tea (2016-2018)
72.	D/PIPa3 Assessment of the microbial status of made tea, and the tea factory environment (factory machinery, water quality and worker hygiene) (Long term)
73.	D/PlPa 1 activities Pathology Division (Long term)
74.	B119 Development of disease assessment keys for Blister Blight & Macrophoma canker (2016-2018)
75.	B116 Development of qPCR technique to screen tea for blister blight resistance(2017-2019)
76.	A 32.3Evaluating & managing pest, disease & weed incidence under sustainable, organic & low input farming systems Evaluating biological & natural pest, disease & weed management methods (2002-2020)
77.	A 48.3 Optimization of electrical energy efficiency in trough withering using a real time heat and mass transfer mathematical model (2015-2018)
78.	A 48.6 Development of an effective monitoring and control system for fluidized bed drying (FBD) of Orthodox Rotorvane teas (2014-2018)
79.	A 48.7 Modifying tea chest packer to suit packling long leafy teas into Tea Kraft bags (2017-2019)
80.	B 123 Removal of Stalk and/or Fibre before Drying (2017-2018)
81.	D TECH Divisional Activities (Long term)
82.	A25.3 Evaluating alternative energy sources for tea processing (2017-2018)
83.	A25.6 Investigation on combined IR & fluid bed drying in relation to quality & cost against normal fluid bed drying (2015-2018)
84.	A 25.8 Efficient hot air supply system for Withering Trough (2018-2019)
85.	B106. Factors influencing polyphone content and studies on developing polyphenol enriched black tea (2016-2019)

86.	B107 Simple technique to identify adulterated black tea in the market (2014-2018)
87.	D/Bioch 1 – Activities of the Biochemistry Division (Long term)
88.	A31.5 Investigation on labour turnover & absenteeism in tea plantations (2016-2018)
89.	A 31.6 Investigation on worker shortage in small holder sector
90.	A31.8 Identification of typology & trajectories of tea based peasant farming systems by modeling land use & land cover dynamic changes in low country (2018-2019)
91.	B 1 Exploration on performance of Sri Lanka Tea Industry (2014- ongoing) (2018-2022)
92.	B 127 Impact of Product Diversifiction towards Firm Performance and Growth in Tea Industry(2019-2023)
93.	D/Econ2-Evaluation of research recommendations & micro-analyses for tea sector - Investigation on worker availability in smallholder tea lands-A case study in Ratnapura district (2018-2022)
94.	D/Econ1- Activities of Agricultural Economics Division (Long term)
95.	D/ADV: Development and Maintenance activities of Advisory & Extension Division at Talawakelle (Long term)
96.	D/ADV 1: Routine Advisory and Extension activities (Long term)
97.	D/ADV 3 ; Monitoring, evaluation & extension research
98.	D/ADV 5: Private Public Partnership (PPP) approaches
99.	D/ADV 6 : Mobile extension unit
100.	D/ADV7: Cyber Extension Projects (Long term)
101.	**D/AR**: Adaptive Trials (Long term)
102.	C/ TECH Advisory services (Long term)
103.	C/SPN Developing & maintaining regional analytical laboratory facilities at Head offices, Galle & Hantane (Long term)
104.	C/ENT 1 Developing & maintaining facilities to assess pest damage to made teas for quarantine purposes (Long term)
105.	C/ NEM-Nematode diagnostic service (Long term)
106.	C/PATH (Long term)
107.	C/Bio Service Project (Long term)
108.	C/ADV1: Design and Production of Teaching and Extension Materials (Long term)
109.	C/ADV2: Coordinating the supply of new VP cuttings (mother bush programme)(Long term)
110.	C/AVU Audio Visual services (Long term)
111.	**C/SIA**: Stakeholders Interactive Activities (Long term)

VRI

No	Project Title
1.	Development of in-house ELISA kit for Mycoplasma gallisepticum infection in poultry
2.	Study on use of histopathological and immunohistochemical techniques for detection of bovine tuberculosis
3.	Immunohistopathological study on Porcine Reproductive and Respiratory Syndrome (PRRS) and Porcine Parvo Virus (PPV) infection
4.	PCR based detection of cow milk adulteration in fresh goat milk in Kandy district
5.	Examine the efficacy of selected probiotics and phytobiotics to replace antibiotics in poultry feed
6.	Layer performances and Egg Quality characteristics affecting the hatchability, in village chicken at CPRS, Karandagolla
7.	Identification of two native wild life species in extinction as a technical assistance to prevent illegal slaughtering
8.	Establishment of fatty acid profiles of animal feeds and products
9.	Community based active survey of dog rabies in KaruwappenkernyGramaNiladhari Division in Sri Lanka
10.	Occurrence of Ethanol unstable milk and its relation with physico-chemical characteristics of milk
11.	Development of strip based methods for detection of common adulterants in milk
12.	Characterization of six isolates of A.marginale found from Sri Lanka to obtain the best isolate for cell culture vaccine inoculum
13.	Development of an A. marginale blood vaccine to control the infection at Ridiyagama farm
14.	Introduction of oil adjuvant vaccine to control ND in Sri Lanka
15.	Detection and chracterization of MRSA, ESBL and carbapenem resistant E. coil among isolates in bovine mastitis (Dr. M.A.R. Priyantha
16.	Characterization of ESBL producing E.coil and fluoroquinolone resistant Salmonella species in commercial broilers (Dr. M.A.R. Priyantha)
17.	Isolation, Identification and characterization of strains of contagious ecthyma(orf) virus from goats for development of vaccine (Dr. S. Puvanendiran)
18.	Determining the prevalence of Neospora caninum antibodies in bovines in North Western, Western and Southern provinces (Dr. N.D.S. Disanayaka)
19.	Molecular detection and genetic characterization of *Theileria*parasites among cattle in Sri Lanka (Dr. E. Gunasekara)
20.	Study the present situation , potentials and constraints of growing duck weed and azolla as animal feed substitutes for farm animals in small scale farming systems in Sri Lanka (Mrs. I.K. Leukebandara)
21.	Molecular detection methods and diversity of M. bovis for effective control strategies. (Dr. G.A. Gunawardana)
22.	Molecular tools and Geographical Information System to develop specific control strategies for bovine mastitis. (Dr. G.A. Gunawardana)
23.	Genetic Polymorphism and climate change impact among farm animals (Dr. G.A. Gunawardana)
24.	In vitro and In vivo screening of newly introduced forages for suitable intensification of dairy production in the context climate change

25.	Improving dairy industry to achieve self-sufficient in milk (With University of Peradeniya) (Dr. W.M.P.B. Weerasinghe)
26.	Identification of reliable method for laboratory diagnosis of tuberculosis using nasopharyngeal swabs and saliva of PPD positive cattle and buffalo

Annexure 04: New Products Developed

ACCIMT

No	Products
1.	High Performance Surge Absorber
2.	Wireless Secured Data Logger
3.	Fleet Tracking System
4.	Hexa copter
5.	Fixed Wing UAV
6.	All Terrain Rover Platform

CRI

No	Products
1.	Extra virgin coconut oil

DEA

No	Products
1.	Garcinia dried powder and Garcinia paste were developed as a value-added product.
2.	Greenhouse dryer was designed for black pepper with 13-16 hour drying time at 45 C^0 with the capacity of 130 – 140 kg of fresh pepper

DOM

No	Products
1.	Meteorological data
2.	Issuing weather information
3.	Educational programs on weather

FCRID

No	Products
1.	ANK Wood apple (ACC53)
2.	ANK Wood apple 2
3.	Red onion - AW 1(ACA 13)
4.	Red onion – AW 2 (ACA 56)

ITI

No	Products
1.	Bio Wax formulation
2.	Tree Fresh Formulation
3.	Nutritious scorn / Flat bread
4.	Nutritious biscuit from miner cereals
5.	Whey based beverage
6.	100% herbal balm base from trans esterified coconut oil

NBRO

No	Products
1.	Development of a sensor
2.	Dynamic model & software
3.	Establishing rainfall thresholds to issue for an early warning.

NERDC

No	Products
1.	Paste making machine
2.	Guli polishing machine

NIPM

Products
1. pulse de-huller machines (2) 2. Rice flour shifter (1)

NSF

No	Products
1.	Noninvasive device for screening of patients
2.	ECG machine and patient monitor
3.	E-Health KIOSK – health information platform
4.	Dashboard mounted sleepiness and drowsiness detector
5.	Microbial inoculants for composting of rice straw
6.	Locally made screen printing machine

PRI

No	Products
1	Production of preserved palmyrah young fruit kernel
2	formulation of fruit pulp based ready to serve drink
3	Production of different flavored crude sugar

ROP

No	Products
1.	Database

RRI

No	Products
1.	Reusable fertilizer porous tube Encapsulated slow-release fertilizer coir bricks.

SLINTEC

No	Products
1.	Facial care cosmetic range: 5 products (eye serum, moisturizer, cleanser, facial mask, gel)
2.	Coconut oil-based natural soap
3.	Thermal paste

SRI

No	Products
1.	Fabrication and construction of seedcane cold-water soaking and hot-water treatment plant (HWTP) at Kantale with a treatment capacity of 1.5 tonnes/hour.
2.	Providing technical instructions for installation of new HWTP with a treatment capacity of 01 tonne/hour at Gal-Oya Plantations (Pvt) Ltd.
3.	Constructing 1,750 sqft poly-tunnel for quarantine station at Hantane
4.	Making modifications to the layout of the jaggery processing plant at Kilinochchi
5.	Introducing newly-designed low-cost and easy handling device for furrow line demarcation in furrow bed preparation in undulating topography.

VRI

No	Products
1.	Oil adjutant Vaccine to control New Castle Disease in Poultry
2.	Chocolate coated snack based using milk curd and coconut
3.	A probiotic and phytobiotic mixture as an alternative to prophylactic antibiotics used in animal feed to improve gut health and thereby improve production performances of animals

Annexure 05: New Processes

CRI

No	Processes
1.	Improvement of production process

DEA

Processes
1. The level of glucose in blood was checked by giving cinnamon drink of introduced two varieties (Sri Gemunu & Sri Vijaya). The group consists with staff members in different age group. The results showed, after 14 days of giving "Gemunu" and "Vijaya" cinnamon as a drink, percentage of lowering glucose level is respectively 90% and 86% for a normal people (non-diabetic). The effective percentage of giving these two varieties as a drink for 14 days for diabetic people is 100%.
2. Good canopy development can be obtained by vines originated from uprights of Black Pepper cuttings
3. Control measures for three major diseases of ginger such as soft rot (*Phythium* sp.), bacterial wilt (*Ralstonia* sp) and leaf spot (*Phyllostica* spp) were recommended for disease separately and IDM package was recommended incorporating cultural, physical, biological and chemical control measures.
4. Fertilizer recommendation has been introduced for pepper nurseries using coco peat as new potting media
5. Identified an optimum shade recommendation for ginger cultivation

FCRDI

No	Processes
1.	Seed production program of MICHHY 1 and MICHHY 2 varieties in 15,000ft 2 of protected houses under the guidance of Department Of Agriculture

GJRTI

Processes
1. Gem related Training Processes Gem cutting, Gemmology, Heat treatment, Colour Grading
2. Analytical services (FTIR, XRF, Raman)
3. Geo technical investigations
4.Geological surveys (Gem exploration)

NBRO

No	Processes
1.	Development of low-cost ambient air quality monitoring sensor to measure ambient particulate matter (PM 10)
2.	Landslide Flow Path Analysis
3.	Determination of Threshold Rainfall Limits

NRC

No	Processes
1.	A process to Synthesize Alumina Nanorods from Laterites
2.	Increasing the value of sea cucumber harvests by improving postharvest processing and marketing

RPO

No	Processes
1.	Pesticide residue limit database

RRI

No	Processes
1.	Control release of nutrients to the environment.
2.	Testing of a new chemical (Sodium Nitroprusside) for improved growth and abiotic stress tolerance in rubber plants

SLINTEC

No	Processes
1.	Natural Dying technique
2.	Ti extraction

SRI

No	Processes
1.	Developing an *in-vitro* culture protocol for elimination of Sugarcane Streak Mosaic Virus (SCSMV) from infected sugarcane.
2.	Identifying Quantitative Trait Loci (QTLs) of sucrose content in *Saccharum* genome for marker-aided selection of sugarcane varieties.
3.	Developing a PCR program using SPP1 forward primer and SPP2 reverse primer to detect WLD phytoplasma in a single PCR instead of nested PCR

Annexure 06- New Technologies Developed

CRI

No	Technologies
1.	Centrifugation method

DEA
Technologies
1. Ultra-sonic sound devices with 10 specific frequencies were used to repel vertebrate pest damaged to cinnamon plants as a preliminary study. Less damage to young cinnamon shoots and a smaller number of peacock population were observed in experimental area
2. After one-year period of cinnamon quill packaging Triple layer polypropylene (PET/AL/LLDPE) material showed the least number of insects and it is significantly differed from other types of packaging material (PET/LLDPE, LDPE & PP) except Metalized one. Triple layer polypropylene (PET/AL/LLDPE) showed the least moisture content and Water activity, significantly differed from other materials. Significantly higher oil content was present in cinnamon that packaged from PET/AL/LLDPE and PP than MPET/LLDPE, PET/LLDPE, and LDPE.
3. Application of *T. asperellum* treated cattle manure was identified as a possible alternative for managing quick wilt disease in black pepper in a sustainable manner.
4. Parasitoids of Coffee Berry Borer as biological control agents were identified as *Phymastichus coffea* LaSalle belong to the family Eulophiday of Order Hymenoptera.
5. Thrips and Aulakaphora beetle damage were the higher at nursery stage for new pepper cultivars and essential to good management practices and nursery sanitations to control the pest damages.

6. Natural Colour of Mace can be preserved for 6 months by blanching in 70 ^{0}C temperature for 1-minute time in a sodium meta bi sulphite (SMS) 2.5% solution.
7. Not only clove bud, Clove leaf and stem also can be used to produce essential oil and euginol as they also have higher oil content with a higher euginol percentage.
8. Ginger poly bag cultivation as an improved method, poly bag cultivated ginger field experiment was conducted in Central Research Station of the Department of Export Agriculture (DEA), Matale. The result revealed that best poly bag to grow ginger to get highest growth and yield of ginger is 50 kg poly woven bag filled with 50 l volume of 1:1:1:1 cow dung, coir dust, top soil and sand medium with 100g ginger rhizome as seed material. This result was disseminated to extension staff and farmers.
9. The study done in black pepper fields affected with yellowing confirmed that there is no direct relationship with dry weather or low soil moisture with yellowing incidence of black pepper, but may indirectly influence on occurrence of yellowing. Especially under dry weather, the environmental conditions become more uncomfortable for plants thus under low moisture levels the roots may lose their vigor to absorb water and nutrient successfully. In addition, due to high competitive effects of macro-oganisms such as termite, ants as well as other macro-organisms on plant roots may further reduce the efficiency of absorption of water and nutrients. However, there may be a supportive effect by arbuscular mycorrhyzae (AM) as more AM colonized root identified with non-yellowing plants.
10. Technologies transferred about agronomic practices & management of agronomic practices & management of Export Agricultural crops to University Students and School of Agriculture students at Matale Research Station.
11. Protocols have been developed for in vitro propagation of Turmeric, Ginger and Pineapple
12. New propagation methods for pepper nursery plants have been found out
13. New potting media has been introduced for pepper nursery plants

FCRDI

No	Technologies
1.	Technical package for F1 chili seed production
2.	Identification of sweet sorghum as a suitable mass culture media for *Trichoderma* mass multiplication
3.	Technique for artificial vegifinger was developed using Soybean, Mungbean and Groundnut as a supplement for dairy protein requirement of vegetarians

HORDI

No	Technologies
1.	Use of tissue culture plants as planting material for aeroponic system to increase the seed potato production
2.	Liquid medium was optimized for Lily bulblet production
3.	Two callus induction media were identified for bell pepper anther culture

NBRO

No	Technologies
1.	Sensor technology for automated data collection
2.	GIS (Remote Sensing)
3.	Geological modeling

NERDC

No	Technologies
1.	Smart park monitoring system
2.	Data acquisition module
3.	Manual coconut de-husker

NSF

No	**Technologies**
1.	m-Learning- online English language learning platform
2.	Interactive classroom learning “Student Response System”
3.	Sinhala to sign language translation system for deaf people

ROP

No	Technologies
1.	Developing a database

RRDI

No	Technologies
1.	Bg 312 variety conditionally released

RRI

No	Technologies
1.	Slow release type fertilizer

SLINTEC

No	Technologies
1.	Performance enhanced Lead-acid battery technology
2.	NUEI fertilizer

SRI

No	Technologies
1.	Scaling up of planting materials of the five new-improved sugarcane varieties, SL 00 95, SL 00 354, SL 00 603, SL 00 652, and SL 04 624 released for commercial cultivation in the year 2017, for distribution among sugar companies and farmers. The varieties SL 00 95, SL 00 603 and SL 00 652 were for cultivation under both irrigated and rain-fed conditions, the variety SL 00 354 was for cultivation under irrigation only. The variety SL 04 624 was for jaggery production.
2.	Identifying SL 83 06 and SL 96 128 as the varieties having the highest photosynthetic rate while SL 83 06 and SL 90 6237 as the varieties having the highest transpiration efficiency at elevated (700 ppm) CO_2 and elevated (3^0C higher than ambient) temperature conditions.
3.	Confirming the varieties SL 90 6237 and SL 96 128 as superior on cane and sugar yields under both irrigated and rain-fed conditions in both seasons of yala and maha in all sugarcane-growing areas in Sri Lanka
4.	Identifying Tiafenacil 5% ME as an effective new herbicides for controlling weeds in sugarcane at post-emergent stage.
5.	Recommending Diuron 80 WP and Metribuzin 70 WG for controlling weeds in sugarcane at the following rates: Diuron 80 WP; 3-4 kg/ha in 400 L water at pre-emergent stage Metribuzin 70 WG: 2 kg/ha in 400 L water at pre-emergent stage and 2.5 kg/ha in 400 L water at early-post emergent stage.
6.	Providing an interim fertilizer recommendation for Sugarcane nurseries at Sevanagala and Pelwatte.
7.	Identifying SL 02 315, SL 02 665, SL 02 706, SL 02 932, SL 02 945, SL 05 2237, SL 05 2522, SL 05 2907 and SL 05 3207as better varieties for making sugarcane jaggery.

	Confirming that the best ratio of cane juice and ground nut (60 L of cane juice: 500 g groundnut) for making groundnut-flavoured sugarcane jaggery. Identifying 80% vacuum as the most suitable for vacuum packing for sugarcane jaggery.

VRI

No	Technologies
1.	PCR detection of TetA and blaSHV genes (Tetracycline and ß lactam resistant genes) among bacteria from bovine mastitic milk – adaptation of technology in Sri Lanka
2.	Inter Simple Sequence Repeat PCR method to determine polymorphism among cattle populations - adaptation of technology in Sri Lanka
3.	Magnetic based DNA extraction method for PCR detection of Mycobacterium bovis in milk - adaptation of technology in Sri Lanka

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

1. *Initial draft Submitted to the Commission: 28th April 2021*
2. *First Review: 17th May 2021*
3. *Second Review: 28th December 2021*
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