



**GOVERNMENT OF KERALA  
KERALA STATE PLANNING BOARD**

**FOURTEENTH FIVE-YEAR PLAN  
(2022-2027)**

**WORKING GROUP ON  
SCIENCE AND TECHNOLOGY**

**REPORT**

**INDUSTRY AND INFRASTRUCTURE DIVISION  
MARCH 2022**



## FOREWORD

Kerala is the only State in India to formulate and implement Five-Year Plans. The Government of Kerala believes that the planning process is important for promoting economic growth and ensuring social justice in the State. A significant feature of the process of formulation of Plans in the State is its participatory and inclusive nature.

In September 2021, the State Planning Board initiated a programme of consultation and discussion for the formulation of the 14th Five-Year Plan. The State Planning Board constituted 44 Working Groups, with more than 1200 members in order to gain expert opinion on a range of socio-economic issues pertinent to the plan. The members of the Working Groups represented a wide spectrum of society and includes scholars, administrators, social and political activists and other experts. Members of the Working Groups contributed their specialized knowledge in different sectors, best practices in the field, issues of concern, and future strategies required in these sectors. The Report of each Working Group reflects the collective views of the members of the Group and the content of each Report will contribute to the formulation of the 14th Five-Year Plan. The Report has been finalized after several rounds of discussions and consultations held between September and December 2021.

This document is the Report of the Working Group on “Science and Technology”. The Co-Chairpersons of Working Group were Dr. Satyajit Mayor, Director, National Centre for Biological Sciences, NCBS and Prof. K.P. Sudheer, Principal Secretary, Science and Technology Department and Executive Vice President, KSCSTE. Shri V. Namasivayam, Member of the State Planning Board co-ordinated the activities of the Working Group. Er. Joy N.R, Chief, Industry and Infrastructure Division was the Convener of the Working Group and Smt. Dhanya Chandrasekhar, Research Officer, Industry and Infrastructure Division was Co-Convener. The terms of reference of Working Group and its members are in Appendix 1 of the Report.

**Member Secretary**



## PREFACE

Science, Technology and Innovation (STI) are the key drivers for economic growth and human resource development and also for increasing productivity and competitiveness, which in turn lead to improved job creation, prosperity and overall sustainable development of the State. The approach in the proposed plan period may focus on building a robust Science, Technology and Innovation ecosystem in the State. In order to strengthen science & technological innovations; we need to attract, strengthen and nurture critical human resources; strengthen S&T ecosystem through scientific collaborations, industry-academia research linkage, cutting edge research, innovation and entrepreneurship, technology development & adaptation and world-class infrastructure for Research & Development (R&D). Moreover, we have to enhance the number of researchers involving private sector and also build up individual and institutional excellence in S&T sector. Therefore, investments in S&T in future may lay thrust on above objectives.

In view of its unique geography, climate and population, the State of Kerala possesses opportunities and challenges that are distinctively different from that of the other states of our Country. Taking advantage of these opportunities and challenges for sustainable development, people from the grass root level or those working in advanced institutions and industries must be trained to come up with our own unique, innovative solutions to achieve this. It is in this backdrop, the Government of Kerala have established the Science, Technology and Environment Council (STEC) in 1972 which was reconstituted as Kerala State Council for Science, Technology and Environment (KSCSTE) in 2002 as an autonomous body with a broader mandate and vision to promote and inculcate Science and Technology temperament and associated activities for the benefit of the State of Kerala.

Science and technology institutions have an important role to play in every society for the promotion of excellence in science and technology through learning, research and development with the participation of academia, industry and research organizations and to benefit society through interventions for the improvement of infrastructure, livelihood, amenities and environment, thereby realizing sustainable development and constantly enhancing the quality of life. The State's five year plan can lay focus on science popularisation and promotion, human resources development and up scaling Industry-R&D and Academia interface, international scientific collaborations and funding opportunities, innovation and entrepreneurship, science & technology education, technology development and indigenisation, building robust science and technology infrastructure all with a monitoring, evaluation and feedback framework.

It is vitally important for the development of Kerala that we focus on the vibrant human resource. In this context, unique programmes of KSCSTE cater to developing scientific skills right from the school children and inculcate scientific temperament in them. Other human resource development activities of KSCSTE such as research fellowships, back-to lab programme for women scientists, the Pratibha scholarships for plus two toppers of the

State are all designed in this direction. The special schemes for promoting research and innovation in science, engineering and environment are extending tremendous support for the researches in these areas. The Council has also helped to promote technology development and transfer by providing funding to engineering projects and supporting rural/appropriate technologies. The A. P. J. Abdul Kalam Youth Challenge Programme where the youth are invoked to come up with unique/innovative ideas to solve societal issues and develop entrepreneurial venture. The Patent Information Centre of KSCSTE has been playing an important role in creating awareness about Intellectual Property Rights among the scientific community of the State. In the area of Environment, the Council has supported a large number of projects related to environmental issues and supported a number of eco-clubs in schools and helped in increasing public awareness on the need to protect the ecosystem of the State. During the previous plan period, KSCSTE could also initiate several unique programmes like SHRESTA Centre of Excellence programme, Special schemes for promoting inter institutional and multi-dimensional research, and various schemes for supporting innovation to augment the State's innovation eco-system.

The scientific and research efforts of the R&D Institutions of the Council are noteworthy. The institutions are carrying out mandated research in their relevant areas of expertise, such as Kerala Forest Research Institute (KFRI), Centre for Water Resource Development and Management (CWRDM), Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI), Malabar Botanic Garden and Institute for Plant Sciences (MBGIPS), Srinivasa Ramanujan Institute for Basic Sciences (SRIBS), National Transportation Planning and Research Centre (NATPAC) and Kerala School of Mathematics (KSoM), a joint initiative with Department of Atomic Energy) promoting and practicing S&T relevant to the State. The grant-in-aid Institutions like Integrated Rural Technology Institute (IRTC), Sophisticated Testing and Instrumentation Centre (STIC) have been active in promoting development of S&T in rural sectors as well as providing instrumentation support both for academic institutes as well as industries. It is also worth noticing that in view of the emerging and re-emerging viral infections in the Kerala State, an exclusive research centre Institute of Advanced Virology (Thiruvananthapuram) was established during the period. Similarly, considering the natural disasters like floods and landslides as well as droughts in Kerala, another research for climate change studies - Institute for Climate Change Studies (Kottayam) was established. In order to focus on agricultural research and rural technology development, M.S Swaminathan Research Foundation, Wayanad is attached as another grant-in-aid institution of KSCSTE.

Kerala Biotechnology Commission has initiated many programmes to accelerate the Biotechnology research and development in the State. The efforts of the Commission to bring together industries and R&D institutions of the State to work on industrially relevant problems are noteworthy. KBC's efforts to promote need based biotechnology research relevant to the State and the Biotechnology Integration for Rural Development programme to empower rural folks for sustainable livelihood generation through developing biotechnology related products is a laudable attempt to promote biotechnology at the grass root level.

There are many sectors in Kerala where science and technology can play an important role in making our State more competitive, such as research and innovation in agriculture sector. The Council is planning initiating new programs in partnership with agricultural universities for enabling adaptation of technology available elsewhere or developing them indigenously to solve specific problems. The Council can also take a lead role in making the State more competitive in Education and health-care sectors through partnering with health institutes, R&D centres and Universities in the State.

The recommendations for next Five-Years projected in this document including novel new schemes and programmes initiated for the promotion, support and popularisation of S&T trajectories and the focussed research programmes initiated by the R&D Institutions shall go in a big way for the overall growth and development of the State of Kerala during the next Five-Years and beyond. Interface between Industry, R&D Institutions and Academia need to be strengthened. International Cooperation in S&T sector has become the need of the hour. Science & Technology Education Spectrum need to be widened and deepened. Innovation and entrepreneurship development should be adequately welded together with research activities.

We would like to place on record the invaluable support and help rendered by the members of the Working group, the Vice-Chairperson and members of the Kerala State Planning Board and the Staff of the perspective Planning Divisions as well as the Directors of the R&D Institutes of KSCSTE and scientists of KSCSTE HQ for the compilation of this report. Hope and wish that this document becomes a blue print for formulating the Fourteenth Five-Year Plan for the overall growth of the State through Science & Technology interventions.

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## CONTENTS

Sl. No		Page Number
1	List of Tables	03
	Chapter 1 Introduction	05
	Chapter 2 Review of S&T Eco System during 13 <sup>th</sup> Plan	09
2	Chapter 3 Challenges in S&T sector and possible redressal measures during 14th Five Year Plan	19
	Chapter 4 Recommendations for the 14th Five Year Plan	25
	Chapter 5 Summary and Conclusion	33
3	Appendix-I	35
	Appendix-II	38
	Appendix-III	39



## LIST OF TABLES

Sl. No.	Title	Page No.
1	Year-wise outlay and expenditure of institutions under S&T sector (consisting of KSCSTE, IAV & RCC) during the 13 <sup>th</sup> Five Year Plan	09
2	Major accomplishments of KSCSTE HQ and its R&D centres during 13 <sup>th</sup> Five- year plan	11
3	Financial Performance of R& D Institutions of KSCSTE during 13 <sup>th</sup> Five-Year plan	15
4	Financial Performance of RCC during 13 <sup>th</sup> Five-Year Plan Period	16



# CHAPTER 1

## INTRODUCTION

### 1.1 Overview of S&T Sector in Kerala

The development of any nation anchors on Science, Technology and Innovation, and in India the Central and State Science and Technology Departments are the major actors for developing this sector and creating policy environment for the same. The Kerala State established the State Committee on Science and Technology in 1972 and strengthened the Centre-State partnership in Science and Technology for Development. Kerala was the first State in the country to constitute a State Committee for Science and Technology on the model of the National Committee on Science and Technology. In 2002, Government of Kerala reviewed the structure of the Science, Technology and Environment Committee (STEC) and also the policy on Science, Technology and Environment so that the organization and the policy are in tune with the then conditions and development needs of the State. Consequently, the STEC was also restructured as the Kerala State Council for Science, Technology and Environment (KSCSTE). In line with the Science and Technology policy 2002, the Department of Science and Technology and the Kerala State Council for Science, Technology and Environment have been making quality interventions in the S&T development of Kerala viz. science education, scientific research, environmental protection and in traditional systems of knowledge and innovation.

The focus of Science and Technology Department in Kerala remained targeted equally on scientific awareness among all sections of the society, and on augmented role of Science, Technology and Innovation in modernisation of productive economic sectors and development of human resources for the same. While formulating the KSCSTE as an institution, several Research and Development Institutes were brought under the ambit of the S&T umbrella of KSCSTE, and they work vigorously on specific focal areas. The focus of KSCSTE and its R&D institutions currently is on research and development in various sectors, capacity building, and catalysing innovation ecosystem at the State level. The Council, along with other research organizations and universities in the State, have been putting concerted effort towards transforming Kerala as a Science driven knowledge economy.

### 1.2 Science, Technology and Innovation Policy 2017 of Kerala

Kerala Government developed Science, Technology and Innovation policy in the year 2017 with special focus on the Sustainable Development and Inclusive Growth in the socio-cultural and economic context of the State of Kerala. This document was in line with the National Science, Technology and Innovation policy. Delivery of Science and Technology led solutions for improving the quality of life of the people and the environment is the thrust of the policy. The major challenge envisaged in the STI Policy (2017) was scientific human resources development

in different disciplines. The policy also calls for possible intervention to be made to ensure sustainable and complete utilization of land, water and forest resources. The policy had prioritized sectors such as maintenance of natural resources, increasing agricultural production, water security, reuse of possible energy sources, protection of biodiversity, etc. Climate change has made these issues more complex and intense, especially in the deterioration of environment and related decline in available resources. Priority should be given to activities that can promote effective use of available resources and thereby improving the environment of the state. The policy suggested several interventions to solve these issues, which includes that the system should open up to coordinate with various government department agencies and industries.

Further, emphasis should be given on research activities in order to extent economic, social and environmental benefits from these resources to the people. Efforts shall also be made to find solutions for critical issues in the field of energy and health-care. A coordinated effort should be made to formulate a comprehensive science-technology innovation frame work for the development of our own traditional systems of medicine like Ayurveda and bring it on a path of action. The government aims at strengthening larger activities in science, technology and innovation sector to make them as driving force for the transformation of the state into a green economy with sustainable development. The policy is presented in view of formulating an action plan to resolve the issues in different developmental activities in the state on a priority basis while assimilating traditional knowledge and utilizing modern knowledge.

### **1.3 Evaluation and Supervision of Science-Technology-Innovation Policy**

The success of the any policy recommendation lies in its effectiveness of implementation. In this regard, an appropriate mechanism needs to be developed for independent monitoring and evaluation.:- A well-defined procedure at the government level needs to be formed to accurately monitor and assess the progress of the activities of the policies being implemented, and to suggest timely corrective measures, if necessary. It is noted that the KSCSTE has developed several indices that can be used in this evaluation procedure.

### **1.4 Working Group on Science and Technology sector**

The Working Group on Science and Technology sector constituted as per the Order given in Appendix-I, consisted of experts and policy makers from various disciplines pertaining to Science & Technology. After one round of discussion, specific thrust areas were identified by the Working Group, and to arrive at specific recommendations pertaining to each of these thrust areas, sub groups were formulated. The thrust areas identified are as follows:

- Science & Technology investment and evaluation of performances
- Human resources development in the State
- Region specific research focus areas for Kerala State.

The sub groups and the working group in total had several round of discussions and deliberations, and the overall suggestions and recommendations are presented in this report.





## CHAPTER 2

### REVIEW OF S&T ECOSYSTEM DURING 13<sup>TH</sup> PLAN

#### 2.1 S&T Ecosystem in the State

The major institutions under the State Government in the S&T sector are the Kerala State Council for Science, Technology and Environment (KSCSTE), Thiruvananthapuram and its Research and Development Centres, spread across the State, Institute of Advanced Virology (IAV), Thiruvananthapuram and the Regional Cancer Centre (RCC), Thiruvananthapuram. In addition, there are several Research Institutions owned by the Central Government in the State as well. The Annexure II details the list of institutions in the State, which includes academic institutions as well. It should be noted that the State hosts more than 200 scientific institutions and all of them have actively contributed to the State's efforts in providing solutions to the issues pertaining to various sectors, such as health, natural disasters, transport, energy, water, biodiversity and climate change.

#### 2.2 Review of institutions under S&T during 13th Five year plan

##### 2.2.1 Budget Allocation and Expenditure

The Thirteenth Five-Year plan earmarked an outlay of Rs. 994.61 crore for scientific services and research (Rs. 476.41 crore for KSCSTE, Rs. 165.00 crore for IAV and Rs. 353.20 crore for RCC ), while it was Rs.716.00 crore (Rs. 501.00 crore for KSCSTE, Rs. 215.00 crore for RCC during the 12th Five Year Plan period. It should be noted that the IAV was established during the 13<sup>th</sup> Five Year Plan period. A glimpse of the plan outlay and expenditure of institutions under S&T sector (consisting of KSCSTE and centres under it, IAV; AND RCC) is provided in the Table 1.

**Table 1.** Year-wise outlay and expenditure of institutions under S&T sector (consisting of KSCSTE and centres under it, IAV; and RCC) during the 13<sup>th</sup> Five Year Plan period

Financial Year	Budgeted outlay (Rs. in Lakhs)	Expenditure (Rs. in Lakhs)	Percentage of Expenditure (%)
2017-18	17507	14000.12	79.97
2018-19	19408	12924.94	66.60
2019-20	22518	6214.10	27.60
2020-21	19764	9739.75	49.28
2021-22	20264	13115.67 (as on 30/3/2022)	64.72

Source: Accounts & Planspace

There is considerable decrease and delay in release in the financial assistance through Plan Funds over the last few years. The financial constraints also led to no recruitment of scientists, which also played a role in the reduction of scientific activities. Nonetheless,

these institutions have contributed to the development of science and technology in the State to the best of their capacity. Although these institutions have been planned with a level of autonomy, the prevailing rules and regulations governing these institutions restrain their autonomy. There is a need to align the rules and regulations in line with other better functioning autonomous institutions with government support. Focusing on full autonomy in their functioning, along with sufficient fund flow, may help improve their performance.

## **2.2.2 Performance of Scientific Institutions**

### **2.2.2.1 Kerala State Council for Science, Technology and Environment (KSCSTE)**

The KSCSTE is an umbrella organization that hosts seven different R&D institutions each of them focusing on different sectoral research such as water, forest, transport, biodiversity (tropical and aquatic plants), basic science and mathematics. During the year 2019, the Institute for Climate Change Studies (ICCS), Kottayam, erstwhile with the Environment Department, was brought under the ambit of Science and Technology Department, primarily to develop inter-institutional and inter-disciplinary research on climate change in collaboration with the R&D centres of the KSCSTE.

While administering the functioning of the R&D centers, the KSCSTE at its Head Quarter manages several schemes and programs that aid in popularizing and promoting science education and conducting cutting edge research in the state. Major accomplishments from the Schemes and Programs of the KSCSTE are listed in **Table 2**.

**Table 2.** Major accomplishments of KSCSTE HQ and its R&D centres during 13<sup>th</sup> Five year plan

Sl. No.	Item	KSCSTE HQ	CWRDM	NATPAC	JNTBGRI	KFRI	MBGIPS	KSOM	SRIBS
1	Patents filed	67*	2	0	0	0	0	0	0
2	Other IPs generated/ Products/ Methods	0	0	0	7	0	0	0	0
3	Patents granted	20*	0	0	1	0	0	0	0
4	Papers in refereed journals	1694*	143	34	346	156	39	30	0
5	Books/ Chapters in Books published	175*	66	1	101	83	3	0	0
6	Papers in Conferences	1343*	126	89	249	134	13	2	0
7	Ph.D awarded	235*	14	0	61	18	7	2	0
8	Training Programmes conducted	63	90	170	34	34	14	21	0
9	Outreach programmes organised	528	56	11	19	7	1	39	22
10	Technologies commercialized/ transferred	21*	5	0	3	13	0	0	0
11	GenBank Submissions/plant accession	0	0	0	95	1000	565	0	0
12	Awards/ Honours	39*	14	3	16	5	6	0	0

(\* Supported through the Schemes and Programmes of KSCSTE)

Source : KSCSTE

The following section depicts a few of the notable achievements from the R&D centers of the KSCSTE:

**Kerala Forest Research Institute (KFRI)**

Establishment of the KFRI-Nodal Centre for Biological Invasions (KFRI-NCBI)

Establishment and maintenance of the Centre for Citizen Science & Biodiversity Informatics.

Long-term monitoring of Permanent preservation plots related to climate change studies in collaboration with: Ghent University, Belgium, University of Leeds, UK

Establishment of Centre for Analytical Instrumentation -Kerala (CAI-K)

Regional Cum Facilitation Centre - Southern Region (RCFC-SR) - a one stop point for all matters related to the medicinal plants sector in the southern region.

BTSG-NBM (South zone), GOI, extends the KFRI team expertise and offers training.

Establishment of the Field Research Station at Malakkappara in 2017

Ecosystem restoration research and River bank stabilization in different forest and impacted landscapes

Bio-restoration of invasive alien impacted landscape

Genomic technologies for conservation of forest genetic resources to mitigate climate change using landscape genetics and gene ecological zonation.

DNA Barcoding of Economically Important Bamboo Species Standardised.

**Centre for Water Resources Development and Management (CWRDM)**

Base line studies on water use efficiency of Kuttiyadi, Malampuzha and Peechi Irrigation Projects

Developed CWRDM-ICNMS (Integrated Crop Nutrient Management Software) Decision Support System for sustaining the soil health and improving crop productivity in TIFAC DST funded project under India- Austria program.

End line Evaluation of 83 watershed projects under PMKSY- Watershed Development Component Programme

Knowledge partner in Wetland Management by MoEF&CC and Key Resource Centre by Ministry of Drinking Water and Sanitation

Developed WATER- Citizen Assessment Tool (WATER-CAT), a mobile application to empower citizens with tools to play an active role in water assessment and monitoring was launched.

NABL accreditation of CWRDM-Water Quality Division Testing Laboratory

Developed a TiO<sub>2</sub> based Nano composite material for the removal of nitrate from drinking water.

### **Jawaharlal Nehru Tropical Botanic Garden & Research Institute (JNTBGRI)**

Development & maintenance of a major conservatory botanic garden with vast living plant collections including most of the endemics of the Western Ghats

Publication of a status report on the endemics of the Western Ghats

Authentic information on the economically important plant resources of the Western Ghats including taxonomic characters, utilization values, useful genotypes for upgradation and development as cultivars.

Phytochemical/ drug prospecting and gene prospecting leading to identification of useful plant molecules, genes and drug precursors.

Identification/formulation of plant based and microbial value-added products for sustainable utilization.

### **National Transportation Planning and Research Centre (NATPAC)**

Resilient transportation planning for disaster prone areas – a case study of Munnar Town

Traffic and Transportation studies for cities/towns in Kerala

Periodic updation of price indices for different public transport and freight operations

Feasibility of multi storied parking facility for Trivandrum Statue Area and Junction improvement of various intersections in Kerala

Traffic impact assessment for various road stretches and Traffic management schemes for various intersections

Assessment of Risk potential of SH in Kerala State

Study on Accidents and Safety Aspects Related to Inland Waterways

Database Creation and Management for Inland Waterways in Kerala Using GIS

Development of GIS-based Road and Traffic Database for Kerala

Design and implementation of Road Safety Schemes on NH48, Gurgaon in association with Maruti Suzuki India Limited.

### **Kerala School of Mathematics (KSoM)**

Apart from the regular PhD programme, KSoM has started an Integrated MSc-PhD program in the year 2020 - an advanced training program at the postgraduate level leading to doctoral studies.

### **Malabar Botanical Garden and Institute for Plant Sciences (MBGIPS)**

Introduced 487 plants to the garden flora

Successfully established the micro-propagation and reintroduction of 5 RET plants and 24 Gen-bank submissions of oil degrading bacteria and algae.

New research facilities and New conservatories and upgradation of existing conservatories

Bio-fortification Garden; a new section demonstrating the vitamin sources in plants are developed.

Established a conservatory exclusively for carnivorous plants and aromatic plants.

Established a new pond for the germplasm collection of Nymphaea and initiated the beautification works by planting different varieties of Heliconia throughout this section.

Established a germplasm collection of Musaceae and Zingiberaceae and a conservatory for Gingers.

### **Institute of Climate change studies (ICCS)**

Memorandum of Understanding (“MoU”) executed on 20-02-2021 between Indian Institute of Technology Madras (IITM) and Institute for Climate Change Studies (ICCS) for academic and research collaboration in the areas of mutual interest

Investigated the influence of aerosols on extreme rainfall events over Kerala:

Remote sensing techniques employed to infer the details regarding aerosol pollution

Formulated a satellite-based technique for nowcasting extreme rainfall events over the State

SWAT hydrologic model has been setup for studying the future climate change impacts especially in deciding the water availability over Chaliyar river basin.

The financial performance of the R&D institutions of KSCSTE during 13th Five-Year Plan Period is given in **Table- 3**.

Table 3. Financial Performance of R& D Institutions of KSCSTE during 13<sup>th</sup> Five-Year plan

(Amount in lakh)

S I. No	Financial Year	KFRI		CWRDM		JNTBGRI		NATPAC		KSOM		MBCIPS	
		Budget Outlay	Expr	Budget Outlay	Expr	Budget Outlay	Expr	Budget Outlay	Expr	Budget Outlay	Expr	Budget Outlay	Expr
1	2017-18	1280	950	1420	1150	1390	1150	720	545	145	90	600	490
2	2018-19	1408	865	1562	960	1529	945	792	4045	165	85	660	421.33
3	2019-20	1310	420	1465	484	1529	499	743	236.67	165	55	660	263
4	2020-21	1000	647.09	1200	782.95	1150	729.9	550	317.67	150	98.29	480	314.15
5	2021-22	1000	778.38	1200	915.97	1250	967	550	419	660	477.64	325	304.16

Source: KSCSTE

### 2.2.2.2 Regional Cancer Centre (RCC), Thiruvananthapuram

Regional Cancer Centre, Thiruvananthapuram (RCC), is an autonomous scientific institution sponsored jointly by the Government of Kerala and Government of India. The centre was established in the year 1980 as a tertiary referral centre for the diagnosis and treatment of cancer. RCC rated amongst the top three of the 28 Regional Cancer Centres in the country. It is the only comprehensive, dedicated centre for diagnosis, treatment and control of cancer in Kerala. On an average 60,000 new patients occur every year in the state and out of this nearly one third comes to RCC for treatment. The Centre undertakes basic, translational and clinical research and disseminates the knowledge. In general, the number of new cases/ review cases registered over a period of time gradually increased. However, with the upgradation of the facilities, RCC could provide treatment and imaging-nuclear medicine studies and investigation reports to the patients.

#### Achievement/Activities

Installation and commissioning of Hyper converged infrastructure (HCI) project and upgradation of Database Appliance

- 30 PhD scholars; 215 research projects
- Three anaesthesia workstations and four ICU ventilators
- Integrated Bipolar & Ultrasonic Cutting & Coagulation Units
- Digital Radiography and Fluoroscopy system
- Supersonic USG machine with Elastography
- Fourier-Transform Infrared Spectrometer
- New 14 storied building: Construction up to 3rd floor completed
- Commissioned Disaster Recovery Site Up-gradation & accessories
- Completed Purchase of Entry Level Server, Workstations & accessories
- Completed the purchase of nearly 30 nos. of most authoritative reference text books in Oncology and allied areas and subscription to 61 international and national journals in Oncology

**Table 4.** Financial Performance of RCC during 13<sup>th</sup> Five-Year Plan Period (Amount in lakh)

Year	Outlay	Exp	%
2017-18	6600	4910.7	74.40
2018-19	7260	7890.9	108.69
2019-20	7260	2777	38.25
2020-21	7100	3274.67	46.12
2021-22	7100	1630.56	22.97

Source: Plan Space Kerala & Accounts



### 2.2.2.3 Institute of Advanced Virology (IAV)

The Institute of Advanced Virology established in 2019 in the Bio 360 Life Sciences Park, Thonnakkal, Trivandrum is envisioned as an institute of global standards networking Global Virology Institutes with most modern laboratories focusing research, diagnose and management of emerging and re-emerging infectious viral diseases, focusing Kerala scenario. The institute with a total project cost of ₹20200.00 lakh is aimed to work for industrial transfer/facilitation of technology and Kerala State Industrial Development Corporation will be a partner in providing land and infrastructure.

The Institute of Advanced Virology (IAV) was inaugurated in October 2020. The clinical virology and viral diagnostic divisions became operational in the prefab building of 25,000 sq. ft in area. The Institute has established six BSL II level labs, One Advanced Diagnostic Facility and a Central Instrumentation Facility with high end research equipments. The major projects being implemented as part of the flagship programme of IAV are:

- Monoclonal Antibodies and Antiviral drug development against emerging viruses.
- Nucleic acid-based vaccines against emerging viruses.
- New generation multiplex diagnostic platforms against viral syndromes.

### 2.3 New Institutions & Initiatives of State Governments

During the last Five Year Plan period, KSCSTE instituted a new scheme called SHRESTA (State Higher Research Centres of Excellence in Science & Technology Applications) which is envisaged for nurturing a few Centres of Excellence (CoE) from the State that produce world-class research in the areas of (i) Floods and Droughts (ii) Viral Research (Biotechnology) (iii) Nanotechnology (iv) Climate Change and (v) Robotics & Artificial Intelligence. The Centre of Excellence (CoE) will be supported in phased manner with grants over a period of 5 years. The overall aim of this programme is to develop Centres of Excellence in the State and facilitate pursuit of high-quality research and development of technologies through substantial investment in the Research Centres/Universities/Institutions. Based on the recommendations of the Executive Committee, the first call for the scheme initiated exclusively for the R&D Institutions of KSCSTE. Accordingly, the proposals from R&D centres of KSCSTE for establishing Centres of Excellence were processed and two proposals recommended for funding through close monitoring and evaluation. The proposals from other institutions will be considered in the second phase.

Another special scheme instituted is **SPIIRC (Scheme for promotion of Inter Institutional Research Collaboration)** which aims to promote Inter Institutional Research Collaboration with a multidisciplinary approach by supporting the collaborative Research proposals from State R&D /Academic Institutions, with National level premium R&D / Academic Institutions, for jointly solving the problems of State/national relevance. R&D Institutions under Govt. of Kerala, Science/ Engineering Departments of State Universities, Research Centres affiliated to any of the Universities in Kerala and Govt. or Aided Colleges in the State are eligible to apply under this scheme. Maximum research grant up to Rs.30

lakh will be provided which will be spread on a span of three years. The objective of the Programme is to enable productive academic and research co-operation by supporting visits of Researchers in Inter Institutional basis.

It is also worth noticing that a framework to rank the performance of KSCSTE research institutions has been developed and accordingly a performance evaluation metrics is designed. Such an initiative will help in ranking the Institutions based on their performance and also for introspection on the achievements and the achievable.

The Government has also planned to establish Institute of Diabetology, to conduct studies. The preliminary work has been initiated by KSCSTE for the said institute.

#### **2.4 S&T supports for Innovation ecosystem**

The KSCSTE launched several new initiatives to support the innovation ecosystem. The A.P.J. Abdul Kalam Youth Challenge Programme targets the youth in the State for taking up challenges in specialized areas which are relevant to the State. Similarly Rural Technology Programme is instituted to encourage and promote rural and grass root innovations by providing financial assistance and technical support to develop traditional/rural technologies or upgrade the existing technologies so that it could be perfected for wider applications and employment generations and to reduce the drudgery of the rural households. The Technology Development & Adaptation Programme (TDAP) provides catalytic support to the innovators by providing financial assistance and technical support for the development of new technologies and adaptation of demand driven technologies. Apart from the above programmes the Rural Innovators meet and TECHFEST provides platform for innovators to exhibit their innovations. Separate Schemes for fostering research & innovation in Science, Engineering and Environment cater to the innovation needs of the State.

## CHAPTER 3

### CHALLENGES IN S&T SECTOR AND POSSIBLE REDRESSAL MEASURES DURING 14<sup>TH</sup> FIVE YEAR PLAN

#### 3.1 Major Challenges in S&T sector

Indian science and technology increasingly present the picture of an inverted pyramid, substantially advanced infrastructure that rests on a fairly weak base. There is a huge concern on the quality across various levels of education, research and application of knowledge and technology. The major challenges faced by the S&T Sector are as follows:

Weak interface between Industry, R&D Institutions and Academia: Non-availability of a platform to enhance industry-academia collaboration was a shortfall during the last plan period. Similarly, an Industry interface in research area selection also could not be created positively.

Another major challenge is to form research groups for consolidating the traditional knowledge repository, and indigenous knowledge and to carry out necessary modern research with the help of developments in science and technology that can be used to bring out the traditional knowledge for the societal benefits.

Availability of data is critical in conducting research and analysis. However, most of the time sufficient data is available as there is no concrete data sharing policy in the state S&T sector.

The line Departments require inputs from various research activities/ analysis on specific projects/ issues. The R&D centres in the State seems to be not the first choice for these Departments and they get it executed through external agencies even outside the State.

Lack of inter-departmental co-ordination, which in turn leads to overlapping or rather duplication of activities. Specifically, there are lot of redundancies between the programs of the S&T Department and Higher Education Department.

The Central instrumentation facilities set up in various institutions/ universities are not open to the researchers or academia from other institutions. Though huge investment is involved with the support of various national funding agencies, the facilities are often underutilised.

Non-functional institutions need to be weeded out.

Human Resource Development: It is pertinent to note that the S&T sector in the State needs to improve its policy and approach to enhance opportunities and attract talented best brains across the country to join hand with the R&D centres and develop research based solutions to the socio-economic issues of the State. A diverse and inclusive human resource base is of much value for S&T to develop/create quality S&T human resources through selectively nurturing excellence in S&T education; identifying talented students and

motivating them to take up science and technology as a career; providing avenues and opportunities for those engaged in the science and technology field.

State should promote the S&T ecosystem by offering better facilities and opportunities for attracting the best talents to work in the State. Attracting and retaining best talents to the Institutes will be the biggest challenge. The Government's decision should be based on benchmarking of the monetary benefits to scientists with similarly placed all India institutions. Simialry investments in establishing world class laboratories in Institutions is critically important to attract talents.

The State has to do much more for the popularization of research findings and S&T outputs. Another limitation was to conduct big budget research and development projects and very limited resource. The limitations in strengthening the infrastructure facilities with poor availability of Plan fund obstruct the scientists in doing world class research.

Financial support: India's Gross Domestic Expenditure on R&D (GERD) is low in comparison to the developed nations and even among many of the developing countries. On the similar line, the financial expenditure on the S&T sector by the State is also on the decline. Therefore, it would be timely to put efforts towards attracting research funds from public and private sectors as well.

Technology Development and Indigenisation: The State should focus on promoting traditional knowledge, systems, developing indigenous technologies and encouraging grass root level innovations.-

International Co-operation: To enhance the scientific abilities of practitioners, cutting across various areas of science and technology, across the globe exposure to the personnel is a keystone towards improving their confidence and will be achieved by world-class collaborations by means of exchanges and mentoring of the scientific community.

Open Science Framework: It is pertinent to develop a strong database/ archive and network of highly skilled and field- based experts. Creation of Digital platforms which will serve as a hub to collectively address the current issues through scientific interventions.

Monitoring, Evaluation and Feedback Framework: An appropriate mechanism for continuous monitoring and timely evaluation of policy and programme implementation is essential to strengthen the system and to ensure quality output.

### **3.2 Strengthening S&T ecosystem**

Improvement in the science and technology ecosystem in Kerala is important in addressing the major challenges that are identified. The enhancement, exchange, and networking of the available pool of talents are the most fundamental aspect of performance improvement in research and technology development. To achieve this, special focus should be given on enhanced capacity building, skill development, and talent identification through various dedicated programs and policies. In addition, a strong program encouraging "incubation" is needed to bring the benefits of the research to the society and for stimulating economic

development in the state. One of the activities that can be focused could be mapping the science and technology infrastructure in the state and to make them available to the stakeholders.

The sector should evolve specific indices, to measure and monitor the performance of the institutions, that consider multiple parameters including achievement, infrastructure, human resources etc. As the State has many agro-ecological- topographical- climatic regions, micro level or localized solutions are needed to address the different issues faced by each region in the State. It is possible only through strengthening the existing scientific institutions. Specific strategies to strengthen each of this institution and realigning their mandates to the State specific problems are essential.

Some of the specific suggestions are highlighted in the following section against each of the activities.

### **3.2.1 Human Resource development in S&T**

Human resources management in higher education sector along with concerted efforts to boost the start-up ecosystem is important. Specific programmes shall be designed to provide more opportunity to bright students in science and exposing people to modern research areas.

Channelise the science talents from school level and nourish those talents through undergraduate programmes and research programmes.

Provide more opportunity to bright students in science and exposing people to modern research areas.

Improve the employability by incorporating industrial exposure and promoting innovations from academic period itself.

Introduce tie-up with the industries to grant students' intern-ship programmes in industries other than seeking funds for research programmes.

Assessment tools for analysing the performance of individual scientists, groups and institutions need to be developed on the basis of globally accepted parameters like publications, IP creating and knowledge transfer. Quality parameters like citation analysis and impact factor need to be incorporated for enhancing the quality of research publication.

Evaluation of the schemes and programs of HR Development established by State and Union Government Programmes need to be done.

### **3.2.2 Academia Industry Linkage**

Most of the academic/ research institutions lack interface with the industry. In order to strengthen the linkage, liaison with government sector entities that work with the industry or support the industry. Such government entities can list out the problems in the respective sectors, in a digitally enabled platform.

Along with the mapping of the facilities in the existing research centres, this will help to link the issues in the sector and the expertise that can try to address the issues.

Also, identify the types of industries situated in the State and their thrust sector. Then try to identify the Research and Development requirement of these industries and connect the industries with the institutions that have expertise in the sector.

### **3.2.3 International collaboration and funding possibilities**

International cooperation in science and technology is essentially a mechanism to enable interaction between scientific researchers to update and refine the knowledge base, develop advanced technology and to take mutual advantage of complementary scientific and technological capabilities. Scientists with broad international exposure, network with a number of research institutions and experience will be an asset in bringing out the world class collaborations and funding opportunities to the State. This helps in the creation of national science and technology assets through optimum utilisation of available resources.

Initiate world class collaborations by means of exchanges with R&D institutions to spur economic development. Competent researchers should be hired and these researchers can attract funding from the central funding agencies.

Focus to be given to promote collaborative research on complex inter-disciplinary issues through funding from reputed institutions both national and international agencies and also from the corporate sector.

Private sector cannot be made to participate in the research and development unless the endeavour matches their requirements. The research institution should engage with the private sector about the need and requirements of the private sector.

### **3.2.4 Technology Development and Indigenisation**

Focus on developing indigenous technologies and encouraging grass root level innovations.

Focus on the indigenous development of technology premised upon assessment and understanding of societal needs keeping in context evolving solutions to people-centric problems.

Emergence of disruptive and impactful technologies poses new challenges and simultaneously greater opportunities.

The promotional activities for the spread of scientific temper amongst all sections of the society need to be addressed. In addition, specific scientific and technology solutions to the stakeholders including the public should be another priority which is possible through science sensitization, indigenisation and popularization.

### **3.2.5 Research, Innovation and Entrepreneurship Development**

Research and Development clusters need to be created based on specific need-based thematic areas and industry-oriented projects/ programmes may be taken up as part of it.

In addition, Science and Technology Incubators should be established at the institutions with financial support and a Start-up culture should be promoted.

More emphasis should be given to set up incubator infrastructure especially in science institutions with special focus on translational research.

### **3.2.6 World class infrastructure for cutting edge R&D**

Climate change and Disaster Risk management are the two vital areas where the State to has to come out with specific solutions and long term strategies. Along with applied research, importance should be given to theoretical and fundamental research areas.

In terms of computation infrastructure point of view, virtual lab may be promoted as it is can be easily scaled up and scaled-down. However, virtual lab models fail to meet the intended objectives of learning in many fields of study especially in sectors that require experimentation. The offline activities cannot be dispensed with, rather it could be augmented with virtual facilities.





## CHAPTER 4 RECOMMENDATIONS FOR THE 14<sup>TH</sup> FIVE YEAR PLAN

### **4.1 Potential Improvements in the Science and Technology sector in Kerala**

The S&T sector in the state has been developing activities to improve the scientific ecosystem in the State. It is noted that an improvement in the current focus of activities may be required to mitigate the challenges that the sector is countering these days. In this premise it is pertinent to note that the approach towards the science and technology development shall be focused considering the following aspects.

Demographic Changes

Land Use Changes

Global warming & Climate Change

Changes in educational opportunities & increase in educated population

### **4.2 Policy recommendations:**

The Working Group constituted as per the G.O. (Annexure-I) for the formulation of the 14th Five year plan had several rounds of discussion. Further, the Committee members were divided into three sub-groups, to arrive with specific recommendations on the following thrust areas:

Science& Technology investment and evaluation of performances

Human Resources Development in the State

Region Specific Research focus areas for Kerala State.

The major recommendations of the Working Group are as follows:

#### **4.2.1 Improving Governance in S&T sector**

A decentralized institutional mechanism focusing on administrative and financial management, research governance, data and regulatory frameworks and system interconnectedness, can be formulated for a robust STI Governance. Strategies should be implemented for modern scientific governance to ensure preparedness for meeting the current challenges and future directions.

There is a critical need to build a robust STI policy governance system with respect to evidence gathering through data and policy research, evidence-based policy making, policy to programme translation and interconnection, implementation, monitoring, review/assessment, and feedback.

Setting up an institutional mechanism for Science Technology and Innovation Policy research in different sectors and thereby strengthening the evidence- supported science

advice mechanism is one of the priorities to develop and nurture an effective, transparent, responsible, accountable and self-reliant STI ecosystem and to guide the planning, implementation, monitoring and evaluation of STI policies and programmes.

Science, technology and innovation (STI) play a pivotal role in poverty eradication and sustainable development. Yet, tapping into the benefits of STI can only be achieved by creating robust STI systems and appropriate policy frameworks.

To address present-day challenges, countries need to reorient STI policies to adopt holistic frameworks, and strategically link integral parts of their national development policies and plans to other sectoral policies such as education, industry, health, etc.

#### **4.2.2 Responsibility of research institutes**

R&D in research institutions and universities can be made relevant through knowledge transfer or dissemination through publications. Applied R&D is only useful if its products can lead to economic development, through industrialization, job creation and poverty reduction. Technology transfer from R&D institutions to industries is low because of weak linkages between R&D and industries and lack of technology transfer culture. Since innovativeness is influenced by collaboration and research institutions / universities technology transfer, it would be advantageous for manufacturing SMEs entrepreneurs to maintain their close collaborations with partners if they are to sustain continual product innovativeness. Specifically, collaboration between the SMEs entrepreneurs, partners and clients or between the SMEs entrepreneurs and research institutions/ universities is critical to facilitating information transfer pivotal to innovative product development. The government should take a lead on this and build on the gains so far made by the research institutions/ universities.

#### **4.2.3 Resource Mobilisation**

One of the most important requirements for research is the need to explore possibilities of funding for a research at regional, national and international levels through public institutes, private industries, NGOs as well as through opportunities for PPP.

Institutes under KSCSTE should take initiatives to augment financial resources from other national and international sources in addition to the direct State funding given the current financial constraints. Government must facilitate this process by incentivising the senior scientists and provide supplementary financial assistance to such efforts.

#### **4.2.4 Gender Equity**

It is reported that in Kerala, the enrolment levels of women at PhD, Post-graduate and Undergraduate Degree are 58%, 64% & 57% respectively. However, the frequency of women representation in R&D institutions is less than 20%. Thus, there is a need to provide support system to attract and retain women; and to encourage girls to take up science as a career. This will also boost their self-esteem and societal recognition.

In this context it is recommended that the number of positions at post-doctoral level be

enhanced through regular and project specific positions. The Institutes should be mandated to achieve the targeted levels of women researchers in their respective organization. If positions are available in the existing institutions, these women can be considered under the the 'Back-to-lab'scheme. The women representation in the leadership positions of these institutions also have to be actively encouraged.

It is also recommended that special programmes envisaged for empowering the women should be designed. Young girls from rural/remote areas in the State may be specially provided fellowships and accommodation to work in state-of-the-art research institutions for a period of a few months which will provide exposure and may kindle interest in science research. Younger trained women tend to drop out because of child-bearing and child-rearing responsibilities, and once out, it is not easy for them to come back in competitive manner. Hence possibilities for them to continue while fulfilling the family responsibilities need to be provided.

### **4.3 Thrust areas**

Kerala is endowed with a rich forest cover spanning more than one – third of the total land area. Forests along with trees outside forests play important economic, social and ecological functions that are critical to the overall prosperity of Kerala. In recent times, along with the economic importance, their role in the provision of ecological services, in particular watershed protection, biodiversity conservation, carbon sequestration and amenity values, is gaining increased attention. The precarious situation with regard to water supply, becoming worse in the past few years, warrants that stable supply of clean water becomes the most important function of the forestry sector in the State.

Forests perform vital function such as interception of high intensity rainfall and facilitate deep percolation and retention of water. But at present these functions are impeded by fragmentation and degradation of forested landscapes and to adapt to these scenarios there should be a paradigm shift in forest management. Shifting forest management to a landscape approach and ensuring linkages with other land uses would be an ideal strategic shift. Addressing the climate vagaries and water shortages by way of pragmatic forest management strategies will be a cost-effective approach for not only improving water governance in Kerala but also other forest functions such as biodiversity conservation, carbon sequestration, sustainable ecotourism, managing human – wildlife conflicts and improving livelihood of forest dependent communities.

Land and water resources are central to agriculture and rural development, and are intrinsically linked to global challenges of food insecurity and poverty, climate change adaptation and mitigation, as well as degradation and depletion of natural resources that affect the livelihoods of millions of rural people across the world. The broader vision of the Land and water policy should ensure equitable access to water and land resources while focusing on the sustainable development. The policy should be directed towards providing knowledge and science-based solutions for managing the Land and water resources, to improve the agricultural productivity and protection of natural resources and environment

in a sustainable way, which is hampered by additional stress from climate variability and climate extreme events such as floods and drought. Policy directions and advisories needs to be formulated to harness the potential of advanced and ready-to-use technologies and promotes research and development to achieve excellence in water and land resources management.

Arresting the declining trends in both quality and quantity of natural resources (Land and water) and addressing climate change concerns will need a paradigm shift in water and environment research and management from its empirical input-centric orientation to knowledge and process-centric orientation. Developments in allied sciences like ecology, ecosystems management, and earth-systems science, and the coupling of concepts from these with new analytic frameworks and spatial technologies, such as Remote Sensing (RS) and geographic information systems (GIS) are yielding powerful tools to enable process knowledge based management of water and natural resources. While the legal decoupling of land and water is deliberate to avoid resource grabbing, the growing intensity of river basin development, and the degree of interdependence and competition over land and water resources, require more adaptable and collaborative institutions that can respond effectively to natural resource scarcity and changing market opportunities. Considering the dynamic demographical patterns, changes in land use and fragile ecosystems of the State, more systematic approach by considering these units in a holistic way is the need of the hour.

The overriding theme of the strategy for managing land and water resources is enhancing individual and institutional capacity for mobilizing and using science and technology to effectively link knowledge with action for inclusive growth and sustainable development with focus on water and land management. Even institutions that are dedicated to integrated regional or basin management deal primarily with either land or water resources and their respective multiple uses, rather than with land and water jointly . Hence such institution needs to be formulated to deal with the land and water management resources in a combined way by considering the sustainability of the ecosystem.

Land and Water Management vision should aim to enhance the standard of living of all citizens by enabling hassle-free access to these two crucial resources, and to equip all stakeholder organisations in attaining higher standards of service delivery without hampering sustainable development. Policy should be designed in such a way that intensification of production on existing agricultural land by effective management of water resources and optimal use of existing available land and water resources. This will require widespread adoption of sustainable land management practices, and more efficient use of irrigation water through enhanced flexibility, reliability and timing of irrigation water delivery. In general, effective governance approach for natural resources is required considering the need of various sectors, equity in distribution, focus on gender and marginalized communities, safety and economics.

### **4.3.1 Initiatives for Strengthening Translational Research**

In order to bridge the gap between research in campuses and practice in all areas of science, technology and engineering, more focus should be given to translational research in the diverse areas of science, technology and engineering. Adequate infrastructure for the academic institutions and universities to support the translation of the technology know how and product designs into actual full-fledged products should be in place. In the current scenario, R&D support for the companies who have successfully graduated from the Incubators and are in the path of scaling up their S&T inputs to the products for innovation and improvisation should be established. Moreover, in order to support for handholding the young innovators and prospective entrepreneurs, a mentor system can be supported with financial compensation. The intellectual property can be protected to sustain interest in the innovation and research and translate the output to revenue earning propositions.

### **4.3.2 Natural Disaster Management**

Most important thing is building up disaster management infrastructure. In addition, evacuation and resettling should be quick and prime requirement. Developmental policies and action plan should give due consideration to ecological fragility and land use pattern. Spatial planning of the land use is also very important. A scientific centre which can specifically work on climate related disaster risk management and developing related strategies is the need of the hour. More than Climate Change which is a global phenomenon, a regional research centre should focus on the impact of associated landslides, flood and drought on the local ecology and livelihood of the community.

### **4.3.3 Health sector**

The health-care system of Kerala is considered a model health system to be followed to achieve a high human development index for a developing economy and it has proved to be the best in India. Kerala leads many other states in having high health-care standards and life expectancy rates, low maternal mortality rate and the lowest infant mortality rate in the country. High literacy rates and women empowerment have contributed significantly toward this achievement. However, Kerala is in the era of an emerging puzzle because of its high morbidity rate with low mortality rate, besides having a significant increase in non-communicable diseases. The robust primary care facilities resulted in a significant increase in chronic degenerative diseases among the middle-aged and adult population. The chronic morbidities, especially illnesses such as hypertension, diabetes and atherosclerosis, known to develop chronic complications such as heart failure and kidney diseases.

### **4.3.4 Initiatives for SC/ST development**

Scheduled Castes (SCs) and Scheduled Tribes (STs) are among the most disadvantaged socio-economic groups in India. The Government of India has enacted progressive legislation, programmes and schemes for the development and empowerment of the SCs and STs. The Government of India also has special schemes to enable access to opportunities including scholarships for education, financial support and skill building for setting up enterprises, reservations in jobs, and special courts to address instances of atrocities and violence. In continuation to the various plan funded schemes, special programmes may be designed to

attract the youth from SC/ST community to pursue research/ career in science..

#### **4.4 Roadmap for the 14<sup>th</sup> Five Year Plan**

The science & technology policy of Kerala envisages for the development of the state through cutting-edge scientific research and innovation in technologies, while integrating the nexus among the academic institutes, research organizations and industries. Kerala has numerous higher education institutes, research organizations and autonomous institutions of national and state importance, which improve the academic environment and serve as a platform for conducting front-line research activities. In general, the research outcomes are generated using computer simulations, field-based and experimental observations, and instrumentation. The computational, experimental and instrumentation facilities offered by the academic and research institutes of the state play a major role in the quality of the research contributions and innovations. Similarly, various higher education institutes, including universities and research organizations of national and state level offers technical and financial support to carry out scientific research mostly for students, researchers and early career scientists across the state.

**4.4.1 Digital Research and Information Platform for Science (DRIPS):** As a measure to improve the quality of the research environment of the state and strengthen the R&D ecosystem, the Kerala State Council for Science, Technology and Environment (KSCSTE) proposes a web-based interactive platform to host various programmes and information about the funding opportunities, technical resources, and research facilities available in the higher education institutes and research organizations of the state. The proposed platform serves as a portal to disseminate information about research funding offered by various national and state funding agencies, link the researchers with required resources, and support the institutions in creating skills development programmes. Further, the platform lists the vacancies available across the academic and research institutions and thereby enabling career pathways to the researchers. The portal would also contain information about the PhD scholars, their specialisation etc. so that a potential employer can search and find out suitable candidates for further consideration. It also allows to advertise the details of research innovations / training programmes / webinars / conferences / experiments through this facility.

**4.4.2 Science & Technology Intervention, Incubation and Research for Raising Start-ups in Kerala (STIRRUP-Kerala):** It is envisaged as an Incubation & Innovation centre at KSCSTE which fosters innovation, research, and entrepreneurial activities in the Kerala State to lead an enterprise based on innovative products. It provides a platform for start-ups by budding entrepreneurs and intrapreneurs to convert their innovative ideas into commercially viable products. It also provides services related to patenting and commercialization. It is a workspace created to offer start-ups and new ventures access to the resources they need for converting the ideas into product.

To develop a robust R&D ecosystem with a wide range of in-house expertise and laboratory facilities and also by networking with specialists and state-of-the-art infrastructural support

available within the Kerala State to augment the prevailing start-up ecosystem. Any inventor who comes with an innovative idea and passion for start-up will be provided with technical and business mentoring, funding opportunities, and necessary support system to translate the idea into a commercial product. STIRRUP ecosystem will provide critical ingredients in setting technology-driven, multidisciplinary innovations across agriculture, forest products, traditional knowledge, drug development from plants, healthcare, water, sanitation, transport and education in the first phase. STIRRUP can offer a plethora of facilities fostering cutting-edge research and innovation. Those who are in the start-up loop and look for an R&D support system can also avail this opportunity.

#### **4.4.3 Science Parks**

Science parks which are considered as the key element in the development of the infrastructure play a significant role in the knowledge economy. They offer shared resources for establishing incubators which will foster innovation and commercialisation of technology in diverse sectors of science and technology. It is proposed to establish four Science Parks in the State and the centers setup in these Science parks will focus on potential areas of applied scientific research. The ecosystem enablers which include incubators, accelerators, mentors, educational institutions, research institutions and the government will facilitate services and resources including initial seed capital, venture capital fund (VCF), angel funds, etc. Suitable Public-Private Partnership (PPP) models will be adopted for the functioning of science parks which will facilitate the resurgence of the local community in the urban area. .

#### **4.4.4 New Initiatives of R&D Centres of KSCSTE**

Programmes to enhance research on appropriate action for climate change management and adaptation strategy, tropical Forestry and its societal importance, better solutions towards water and environmental management and indigenous knowledge;

Bioprospecting (phytochemical and drug prospecting) the medicinal and aromatic plants with the objective of bringing out phytochemicals, biochemical and drug precursors of greater economic value.

Establishment of ex-situ conservatories and Garden Development, Integrated Taxonomy and Conservation Biology, Sustainable Utilization, Biotechnology and Bioinformatics, Capacity Building and Training, each with its prioritized and multidisciplinary components of research.

Fostering the linkage between academic/research institutions and industries;

Framework for effectively bridging the invention-innovation gap and ensuring sustainable development;

Integration of advanced systems like Artificial Intelligence, Machine Learning, Cloud etc. to the research environment of the state.





## CHAPTER 5

### SUMMARY AND CONCLUSION

Today Science and Technology pervades all aspects of the society and it is impossible to engage in any economic activity that is not linked to S&T. Innovations based on S&T help us achieve resource efficiency, and ensure that the benefits also reach to all sections of the society. It is also equally important to develop scientific temper among the people of Kerala to deepen their active participation and support developmental initiatives of the government. It is in this context State level plan expenditure on S&T is essential in order to design programmes of research and innovation that are fine-tuned to the needs and potential of the State. Though the available resources at State level to spend on S&T is limited, compared to the Centre, Kerala has been allocating significantly more money on this sector compared to other States.

Science and technology institutions have an important role to play in every society for the promotion of excellence in science and technology through learning, research and development with the participation of academia, industry and research organizations and to benefit society through interventions for the improvement of infrastructure, livelihood, amenities and environment, thereby realizing sustainable development and constantly enhancing the quality of life.

The 14<sup>th</sup> five year plan can lay focus on science popularisation and promotion, human resources development and up scaling Industry-R&D and Academia interface, international scientific collaborations and funding opportunities, innovation and entrepreneurship, science & technology education, technology development and indigenisation, building robust science and technology infrastructure all with a monitoring, evaluation and feedback framework.

The following objectives are drawn up for the 14th Five Year Plan period:

- Focus on building a robust Science, Technology and Innovation ecosystem in the State. The academic, research, industry and central & state government collaboration to be enhanced. The linkages and collaboration between Central Research Institutions in Kerala and elsewhere in the country to be strengthened.
- Attractive funding/incentives for S&T startups
- Increased State share to S&T sectors along with external funding for R&D activities
- Invest on world-class R&D infrastructure and facilitate the accessibility of the infrastructure among various research and educational institutions
- Strengthen the directly funded research institutions under GoK by adopting best practices such as Peer Reviews to evaluate the impacts and fine-tune their mandates and focus.
- Promote scientific temper among youth and students by engaging in Kerala specific public concerns through well informed programs and conferences.

For achieving the above objectives and excellence in Science and Technology, the following areas need to be strengthened.

Research and technology development - The enhancement, exchange, and networking of the available pool of talents are the most fundamental aspect of performance improvement in research and technology development. For this purpose, the emphasize and the focus should be on, enhanced capacity building, skill development, and talent identification through various dedicated programs and policies.

Scientific collaboration and funding opportunities - Scientist's with broad international exposure, network with a number of research institutions, and experience will be an asset in bringing out the world class collaborations and funding opportunities to the state. To enhance the scientific abilities, world-class collaborations should be brought in by means of exchanges and mentoring of the scientific community.

Synergistic collaboration with education systems - There should be strong and in-tandem association with the educational system to scout the talent cutting across various fields, at an early age and to provide them unique and world class exposure to foster motivation in science.

Dissemination of knowledge - The influence of knowledge can never be appreciated unless it is distributed for the betterment of the society. A strong database and network of highly skilled and field-based experts has to be built. This initiative could serve as a hub to collectively address the root cause of current and future problems through scientific interventions.

All the existing research institutions in the State, whether Central, State or Private/NGO are to be mapped and detailed SWOT analysis to be conducted. Specific strategies to strengthen each of this institution and realigning their mandates to the State specific problems are essential. Research-Academia-Industry linkage should be strengthened and convergence and integrations among various institutions and governmental departments/agencies have to be further strengthened. Priority setting, monitoring, evaluation and corrective measures based on constant stake holder consultations are also vital.

Human resources management in higher education sector along with concerted efforts to boost the start-up ecosystem is important. An effective knowledge dissemination system is to be formulated to learn and understand the science and technology developments happening within and outside India and transforming them in accordance with the requirements of the state. Moreover, steps are to be taken for the effective coordination of research activities conducted by different agencies in the state.

## APPENDIX I

### PROCEEDINGS OF THE MEMBER SECRETARY

#### STATE PLANNING BOARD

(Present: Sri. Teeka Ram Meena IAS)

Sub: - Formulation of Fourteenth Five Year Plan (2022-27) – Constitution of Working Group on **Science and Technology Sector** – reg.

Read: 1. Note No. 297/2021/PCD/SPB dated: 27/08/2021  
2. Guidelines on Working Groups

#### **ORDER No. 951/2021/I&I/SPB/RO2/WG 7 Dated: 13/09/2021**

As part of the formulation of Fourteenth Five Year Plan, it has been decided to constitute various Working Group under the priority sectors. Accordingly, the Working Group on **Science and Technology** Sector is here by constituted with the following members. The Working Group shall also take into consideration the guidelines read 2<sup>nd</sup> above in fulfilling the tasks outlined in the ToR for the Group.

#### **Co - Chairpersons**

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#### **Co- Convener**

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#### **Terms of Reference**

1. To review the science and technology investments in the State during the 13th Five-Year Plan and its achievement against the stated objectives.
2. To review the academic and scientific achievement and potential of science and technology institutes in the State, identify those which show particular promise in their fields.
3. Propose means of making science and technology centres important centres of research and building links between science and technology centres and teaching institutes.

#### **Terms of Reference (General)**

The non-official members (and invitees) of the Working Group will be entitled to travelling allowances as per existing government norms. The Class I Officers of GoI will be entitled to travelling allowances as per rules if reimbursement is not allowed from Departments.

The expenditure towards TA, DA and Honorarium will be met from the following Head of Account of the State Planning Board “3451-00-101-93”- Preparation of Plans and Conduct of Surveys and Studies.

(Sd/-)  
Member Secretary

To

The Members concerned

Copy to

PS to VC

PA to MS

CA to Member (Sri. V. Namasivayam)

Sr. A.O, SPB

The Accountant General, Kerala

Finance Officer, SPB

Publication Officer, SPB

Sub Treasury, Vellayambalam

Accounts Section

File/Stock File

Forwarded by Order

(Sd/-)

Chief Industry & Infrastructure Division  
(Convener)

## APPENDIX II

### MEMBERS OF SUB-GROUPS FORMED

#### **Sub Group -1 Sub Group on Review of the Science and Technology investment and evaluation of performances**

##### **Members**

Prof. Rohini Godbole	:	Member
Dr. E. Sreekumar	:	Member
Prof. Jarugu Narasimha Moorthy	:	Member
Prof Madhavan Mukund	:	Member
Dr Rajasree M S	:	Member - Co-ordinator

#### **Sub Group -2 Sub Group on Human Resources Development in S&T**

##### **Members**

Prof.P Sunil Kumar	:	Member
Dr. Chandrabhas Narayana	:	Member
Dr. Rajesh Gopakumar	:	Member
Prof. A. Jayakrishnan	:	Member
Dr.Sudeshna Sinha	:	Member
Dr. Samson Mathew	:	Member - Co-ordinator

#### **Sub Group -3 Sub Group on Region Specific Research Focus Areas**

##### **Members**

Dr. Ajith Parameswaran	:	Member
Dr. Muhammed Hatha Abdulla	:	Member
Dr. Sandipan Baksi	:	Member
Prof. Kalyan Chakraborty	:	Member
Dr. Syam Viswanath	:	Member
Dr. Manoj P Samuel	:	Member (Co-ordinator)

### APPENDIX III

#### List of Research Institutions in Kerala

S l . No	Research Centres	Recognised University	Subject	Institution Category
1	Centre for Development of Advanced Computing (CDAC)	Kerala University	Information & communication Technology and electronics	Scientific Research Institution
2	Central Institute of Fishery Technology (CIFT)	Kerala University, CUSAT	Fishery & Technology	Scientific Research Institution
3	Central Marine Fisheries Research Institute (CMFRI)	Kerala university, CUSAT	Marine Science	Scientific Research Institution
4	Central Marine Fisheries Research Institute, Vizhinjam	Kerala University	Marine science	Scientific Research Institution
5	Central Plantation Crops Research Institute	Kerala University, Kannur	Agriculture	Scientific Research Institution
6	Central Plantation Crops Research Institute, Kayamkulam	University, Kerala university, Calicut	Agriculture	Scientific Research Institution
7	Central Tuber Crops Research Institute (CTCRI)	Kerala University, Kannur	Agriculture	Scientific Research Institution
8	Centre for Development of Imaging Technology	University, Kerala university	Information science & Technology	Scientific Research Institution
9	Centre for Development Studies	Kerala university	Agriculture, Natural resources	Scientific Research Institution

10	National Centre for Earth Science Studies	Kerala university, Cusat, MG University Kerala university	Earth Science	Scientific Research Institution
11	Forensic Sciences Lab	Kerala university	Forensic science	Scientific Research Institution
12	Lal Bahadur Sastri Centre for Science & Technology	Kerala university	Science & Technology	Scientific Research Institution
13	Metabolic Disorders Research Centre	Kerala university	Biochemistry	Scientific Research Institution
14	Mitraniketan	Kerala university	Psychology	Scientific Research Institution
15	NIIST-CSIR	Kerala university, CUSAT, MG University Kerala university, MGU	Science & Technology	Scientific Research Institution
16	Rajiv Gandhi Centre, for Bio-Technology	Kerala university, MGU	Science & technology	Scientific Research Institution
17	Regional Cancer Centre	Kerala university	Medical Science	Scientific Research Institution
18	Santhigiri Institute of Bio-Science	Kerala university	Biotechnology, Ayurveda, sidha	Scientific Research Institution
19	Sree Chithra Thirunal Institute of Medical Science	Kerala university	Medical science & technology	Scientific Research Institution
20	State Nutrition Laboratory	Kerala university	Health science	Scientific Research Institution
21	The Cashew Export Promotion Council of India (CEPC)	Kerala university, Kannur University	Biotechnology & Microbiology	Scientific Research Institution
22	The Kerala State Drugs & Pharmaceuticals Ltd	Kerala university	Health science	Scientific Research Institution
23	The Rubber Research Institute of India	Kerala University, CUSAT, MG University	Polymer science & Rubber Technology	Scientific Research Institution



24	Jawaharlal Nehru Tropical Botanical Garden and Research Institute	Kerala University, Kannur	Plant science	Scientific Research Institution
25	V.S.S.C	University Kerala University, MG CUSAT, MG University CUSAT	Space Science	Scientific Research Institution
26	Central Institute of Fisheries Nautical and Engineering Training (CIFNET)	University CUSAT	Fisheries & technology	Scientific Research Institution
27	Marine Products Export Development Authority (MPEDA)	CUSAT	Marine Science	Scientific Research Institution
28	Naval Physical & Oceanographic Laboratory (NPOL)	CUSAT	Material Science, Ocean Science, Opto Electronics	Scientific Research Institution
29	National Institute of Oceanography (NIO)	CUSAT	Marine Science	Scientific Research Institution
30	Kerala Forest Research Institute (KFRI)	CUSAT, Calicut	Zoology, Forestry	Scientific Research Institution
31	Cochin Base of Fishery Survey of India (FSI)	CUSAT	Fisheries Science	Scientific Research Institution
32	Central Coir Research Institute	CUSAT	Biotechnology	Scientific Research Institution
33	Centre for Bio-Polymer Science & Technology (CBPST)	CUSAT	Bio-Polymer Science & Technology	Scientific Research Institution
34	Indian Institute of Information Technology & Management- Kerala	CUSAT	Computer Science	Scientific Research Institution

35	National Institute of Fisheries Post Harvest Technology and Training (NIFPHATT)	CUSAT	Fisheries	Scientific Research Institution
36	Space Physics Laboratory (SPL)	CUSAT	Space science	Scientific Research Institution
37	Centre for Water Resources Development and Management (CWRDM)	CUSAT, Kannur, Calicut	Natural science	Scientific Research Institution
38	Centre for Marine Living Resources and Ecology (CMLRE)	CUSAT	Marine science	Scientific Research Institution
39	Centre for medical research and non-communicable disease, CMRNCD	Kannur university	Medical Science	Scientific Research Institution
40	Centre for medicinal plants research,	Kannur University	Biochemistry	Scientific Research Institution
41	Indian Institute of Spices Research	Kannur University, Calicut	Agriculture	Scientific Research Institution
42	Amalga Cancer research Centre	MGU, Calicut	Medical Science	Scientific Research Institution
43	Kunnath Institute of Medical Science	MGU	Biochemistry	Scientific Research Institution
44	Little Flower Medical Research Centre	MGU	Biochemistry	Scientific Research Institution
45	ERRC	MGU	Environmental science	Scientific Research Institution
46	Rice Research Station	MGU	Agriculture	Scientific Research Institution
47	C-MET	MGU	Information & Communication Technology	Scientific Research Institution

48	Centre for Mathematical Sciences	MGU	Mathematics	Scientific Research Institution
49	Chinmaya International Foundation	MGU	Psychology	Scientific Research Institution
50	CIFRC	MGU	Zoology	Scientific Research Institution
51	Malabar Botanical Garden	Calicut	Plant Science	Scientific Research Institution
52	Zoological survey of India	Calicut	Zoology	Scientific Research Institution
53	Kerala Agricultural university	Calicut	Agriculture, Zoology,	Scientific Research Institution
54	Department of Aquatic Biology & Fisheries	Kerala University	Aquatic Biology & Fisheries	Academic Research Institution
55	Department of Bio-Chemistry	Kerala University	Bio-Chemistry	Academic Research Institution
56	Department of Bio-Technology	Kerala University	Bio-Technology	Academic Research Institution
57	Department of Botany	Kerala University	Botany	Academic Research Institution
58	Department of Chemistry	Kerala University	Chemistry	Academic Research Institution
59	Department of Computational Biology & bioinformatics	Kerala University	Computational Biology & bioinformatics	Academic Research Institution
60	Department of Computer Science	Kerala University	Computer Science	Academic Research Institution
61	Department of Environmental Sciences	Kerala University	Environmental Sciences	Academic Research Institution

62	Department of Geology	Kerala University	Geology	Academic Research Institution
63	Department of Mathematics	Kerala University	Mathematics	Academic Research Institution
64	Department of Optoelectronics	Kerala University	Optoelectronics	Academic Research Institution
65	Department of Physics	Kerala University	Physics	Academic Research Institution
66	Department of Psychology	Kerala University	Psychology	Academic Research Institution
67	Department of Statistics	Kerala University	Statistics	Academic Research Institution
68	Department of Zoology	Kerala University	Zoology	Academic Research Institution
69	Centre for Nano science and Nanotechnology	Kerala University	Nano science and Nanotechnology	Academic Research Institution
70	Bishop Moore College	Kerala University	Chemistry, Physics	Academic Research Institution
71	Centre for Bio- Informatics	Kerala University	Bio- Informatics	Academic Research Institution
72	Centre for Geo Information Science and Technology	Kerala University	Geo Information Science and Technology	Academic Research Institution
73	C.M.S College	Kerala University	Botany, Chemistry	Academic Research Institution
74	DB College, Sasthamcottah	Kerala University	Chemistry	Academic Research Institution
75	F.M.N.College	Kerala University	Zoology, Chemistry, Physics	Academic Research Institution
76	Govt. Ayurveda College	Kerala University	Medical science	Academic Research Institution

77	Govt. College of Nursing	Kerala University	Medical science	Academic Research Institution
78	Govt. Dental College	Kerala University	Medical science	Academic Research Institution
79	HHMSPBNSS College for Women	Kerala University	Physical Education	Academic Research Institution
80	Lal Bahadur Sastri Centre for Science & Technology	Kerala University	Zoology, Chemistry, Physics, Maths	Academic Research Institution
81	Mar Ivanios College	Kerala University	Zoology, Chemistry, Physics, Maths	Academic Research Institution
82	Medical College	Kerala University		Academic Research Institution
83	M.G.College	Kerala University	Physics, Botany, Zoology, Chemistry	Academic Research Institution
84	NSS College, Pandalam	Kerala University		Academic Research Institution
85	(Zoology) SD College, Alappuzha	Kerala University	Botany, Zoology, Commerce, Chemistry	Academic Research Institution
86	S.N. College for Women, Kollam	Kerala University	Chemistry	Academic Research Institution
87	S.N College, Chempazhanchy	Kerala University	Chemistry	Academic Research Institution
88	S.N.College, Cherthala	Kerala University	Zoology	Academic Research Institution
89	S.N College, Kollam	Kerala University	Chemistry, Physics, Botany, Zoology	Academic Research Institution
90	T.D.Medical College, Alappuzha	Kerala University	BioChemistry	Academic Research Institution
91	Union Christian College, Aluva	Kerala University	Botany	Academic Research Institution
92	University College, Thiruvananthapuram.	Kerala University	Physics, Chemistry, Zoology, Maths, Botany	Academic Research Institution

93	Govt. College for Women	Kerala University	Physics, Chemistry, Zoology, Psychology, Botany	Academic Research Institution
94	T K M College of Arts & Science	Kerala University	Physics	Academic Research Institution
95	St. Stephen's Pathanapuram	Kerala University	Zoology	Academic Research Institution
96	Dept. of Life Sciences, Thalassery Campus, Palavud.	Kannur University	Life Sciences	Academic Research Institution
97	Govt. College, Kasaragod	Kannur University	Statistics, Chemistry & Zoology	Academic Research Institution
98	Nehru Arts & Science College, Kanhangad	Kannur University	Statistics	Academic Research Institution
99	Govt. Brennen College, Dharmadam, Thalassery	Kannur University	Physics	Academic Research Institution
100	S.N. College, Kannur	Kannur University	Chemistry, Zoology, Botany	Academic Research Institution
101	Department of Information Technology, University Campus, Mangattuparumba	Kannur University	Information Science & Technology	Academic Research Institution
102	Sir Syed College, Taliparamba, Kannur Dt	Kannur University	Botany, Chemistry	Academic Research Institution
103	Mary Matha Arts & Science College, Mananthavady	Kannur University	Mathematics, Zoology	Academic Research Institution
104	Dept. of Chemistry, School of Chemical, Sciences, Payyanur	Kannur University	Chemistry	Academic Research Institution
105	Dept. of Physics, School of Pure & Applied Physics, Payyannur Campus	Kannur University	Physics	Academic Research Institution
106	Payyannur College, Payyannur	Kannur University	Mathematics, Physics,	Academic Research Institution

107	Department of Chemistry	Kannur University Kannur	Chemistry	Academic Research Institution
108	School of Behavioural Sciences	University Kannur	Psychology	Academic Research Institution
109	Department of Medical Biochemistry/Medical Microbiology	University Kannur University	Medical Biochemistry, Medical Microbiology	Academic Research Institution
110	Department of Mathematical Science, Kannur University ,Mangattuparamba.	Kannur University	Mathematical Science	Academic Research Institution
111	Department of Statistical Science, Kannur University, Mangattuparamba	Kannur University	Statistical Science	Academic Research Institution
112	Department of Zoology,	Kannur University	Zoology	Academic Research Institution
113	Department of Chemistry Nirmalagiri College, Kuthuparamb	Kannur University	Chemistry	Academic Research Institution
114	Department of Biotechnology	University of Calicut	Biotechnology	Academic Research Institution
115	Department of Botany	University of Calicut	Botany, Biotechnology, Microbiology, Immunology & Environmental Science	Academic Research Institution
116	Department of Chemistry	University of Calicut	Chemistry	Academic Research Institution
117	Department of Computer Science	University of Calicut	Computer Science	Academic Research Institution

118	Department of Life Sciences	University of Calicut	Biochemistry, Microbiology & Physiology	Academic Research Institution
119	Department of Mathematics	University of Calicut	Mathematics	Academic Research Institution
120	Department of Nano science & Technology	University of Calicut	Nano science	Academic Research Institution
121	Department of Physics	University of Calicut	Physics	Academic Research Institution
122	Department of Psychology	University of Calicut	Psychology	Academic Research Institution
123	Department of Statistics	University of Calicut	Statistics	Academic Research Institution
124	Department of Zoology	University of Calicut	Zoology, Biochemistry	Academic Research Institution
125	MES Ponnani College, Ponnani	University of Calicut	Aquaculture & Fishery Microbiology;	Academic Research Institution
126	Government Victoria College, Palakkad	University of Calicut	Geology, Botany, Chemistry	Academic Research Institution
127	Sree Krishna College, Guruvayur	University of Calicut	Botany	Academic Research Institution
128	Sree Narayana College, Nattika	University of Calicut	Botany	Academic Research Institution
129	St. Joseph's College, Devagiri, Kozhikode	University of Calicut	Botany	Academic Research Institution
130	The Zamorin's Guruvayurappan College, Kozhikode	University of Calicut	Botany	Academic Research Institution
131	MES Asmabi College, P.Vemballur, Kodungalloor	University of Calicut	Botany	Academic Research Institution



132	St. Thomas College, Thrissur	University of Calicut	Botany	Academic Research Institution
133	Sri Neealakanda Government Sanskrit College, Pattambi	University of Calicut	Botany	Academic Research Institution
134	Christ College, Irinjalakuda	University of Calicut	Chemistry, Environmental Science, Geology, Physics, Zoology	Academic Research Institution
135	Farook College, Kozhikode	University of Calicut	Chemistry, Computer Science, Physics, Statistics	Academic Research Institution
136	Government Victoria College, Palakkad	University of Calicut	Chemistry, Physics, Zoology	Academic Research Institution
137	Malabar Christian College, Kozhikode	University of Calicut	Chemistry, Zoology	Academic Research Institution
138	Sri Neealakanda Government Sanskrit College, Pattambi	University of Calicut	Chemistry	Academic Research Institution
139	Sri Vyasa N.S.S. College, Thrissur	University of Calicut	Chemistry	Academic Research Institution
140	St. Joseph's College, Devagiri, Kozhikode	University of Calicut	Chemistry, Mathematics	Academic Research Institution
141	St. Joseph's College, Irinjalakuda	University of Calicut	Chemistry, Mathematics	Academic Research Institution
142	St. Thomas College, Thrissur	University of Calicut	Chemistry	Academic Research Institution
143	PSMO College, Thrurangadi	University of Calicut	Chemistry	Academic Research Institution
144	MES Keeveeyam College, Valancherry	University of Calicut	Chemistry	Academic Research Institution
145	St. Mary's College, Thrissur	University of Calicut	Mathematics	Academic Research Institution

146	Kerala School of Mathematics, Kunnamangalam, Kozhikode	University of Calicut	Mathematics	Academic Research Institution
147	Govt. College, Chittur	University of Calicut	Mathematics	Academic Research Institution
148	St. Thomas College, Thrissur	University of Calicut	Mathematics, Physics, Statistics, Zoology	Academic Research Institution
149	Providence Women's College, Kozhikode	University of Calicut	Physics	Academic Research Institution
150	Vimala College, Thrissur	University of Calicut	Physics	Academic Research Institution
151	Sree Krishna College, Guruvayur	University of Calicut	Physics	Academic Research Institution
152	St. Joseph's College, Devagiri, Govt. College, Madappally	University of Calicut	Physics, Zoology	Academic Research Institution
153	M.E.S. Mampad College, Mampad	University of Calicut	Zoology	Academic Research Institution
154	Prajyothi Nikethan College, Pudukkad	University of Calicut	Psychology	Academic Research Institution
155	Department of Applied Chemistry	CUSAT	Applied Chemistry	Academic Research Institution
156	Department of Biotechnology	CUSAT	Biotechnology	Academic Research Institution
157	Department of Mathematics	CUSAT	Mathematics	Academic Research Institution
158	Department of Physics	CUSAT	Physics	Academic Research Institution
159	Department of Statistics	CUSAT	Statistics	Academic Research Institution
160	Department of Atmospheric Sciences	CUSAT	Marine science	Academic Research Institution
161	Department of Chemical Oceanography	CUSAT	Marine science	Academic Research Institution

162	Department of Physical Oceanography	CUSAT	Marine science	Academic Research Institution
163	Department of Marine Biology, Microbiology and Biochemistry	CUSAT	Marine science	Academic Research Institution
164	Department of Marine Geology and Geophysics	CUSAT	Marine science	Academic Research Institution
165	School of Industrial Fisheries	CUSAT	Marine science	Academic Research Institution
166	Department of Computer Applications	CUSAT	Technology	Academic Research Institution
167	Department of Computer Science	CUSAT	Technology	Academic Research Institution
168	Department of Electronics	CUSAT	Technology	Academic Research Institution
169	Department of Instrumentation	CUSAT	Technology	Academic Research Institution
170	International School of Photonics	CUSAT	Technology	Academic Research Institution
171	Department of Polymer Science and Rubber	CUSAT	Technology	Academic Research Institution
172	Department of Ship Technology	CUSAT	Technology	Academic Research Institution
173	College of Fisheries	MGU	Aqua Culture	Academic Research Institution
174	N.S.S Hindu College Changanacherry	MGU	Aquatic Biology & Fisheries	Academic Research Institution
175	School of Bio Sciences	MGU	Biochemistry, Biotechnology, Zoology	Academic Research Institution
176	St. Thomas College, Palai	MGU	Botany, Biochemistry, Chemistry, Mathematics, Statistics	Academic Research Institution

177	U.C. College, Aluva	MGU	Botany, Chemistry, Bio Physics, Mathematics, Statistics, Physics Bio-Sciences	Academic Research Institution
178	Mar Athanasius College for Advanced Studies, Thiruvalla	MGU	Botany, Chemistry, Polymer Chemistry, Home Science, Applicable Mathematics, Microbiology, Physics, Zoology	Academic Research Institution
179	C.M.S. Colleges, Kottayam	MGU	Botany, Home Science, Applicable Mathematics, Microbiology, Physics, Zoology	Academic Research Institution
180	S.B. College, Changanacherry	MGU	Botany, Chemistry, Physics, Zoology	Academic Research Institution
181	St. Teresas Ernakulam	MGU	Botany, Home Science, Physics	Academic Research Institution
182	Mar Thoma College, Tiruvalla	MGU	Botany, Chemistry, Applicable Mathematics, Physics, Zoology	Academic Research Institution
183	S.H. College, Thevara	MGU	Botany, Chemistry, Physics, Zoology	Academic Research Institution
184	Catholicate College, Pathanamthitta	MGU	Botany, Mathematics, Applicable Mathematics, Physics, Zoology	Academic Research Institution
185	St.Thomas, Kozhencherry	MGU	Zoology Botany, Chemistry, Physics, Zoology, Biochemistry	Academic Research Institution

186	St. Albert's College, Ernakulam	MGU	Botany, Chemistry, Mathematics,	Academic Research Institution
187	St. Peter's College, Kolencherry	MGU	Zoology Botany	Academic Research Institution
188	School of Chemical Sciences M.G. University Assumption College	MGU	Botany	Academic Research Institution
189	St. Alberts College, Ekm	MGU	Botany, Zoology	Academic Research Institution
190	Nirmala College, Muvattupuzha	MGU	Applied Botany	Academic Research Institution
191	Maharajas College, Ernakulam	MGU	Chemistry ,Statistics, Zoology	Academic Research Institution
192	M A College, Kothamangalam	MGU	Chemistry, Polymer Chemistry, Marine pollution, Biochemistry, Physics,	Academic Research Institution
193	St. Joseph's College, Moolamattom STAS, Kottayam	MGU	Zoology Chemistry , Polymer Chemistry, Physics, Zoology, Biochemistry	Academic Research Institution
194	St. George's College, Aruvithura	MGU	Chemistry ,Electronics, Physics	Academic Research Institution
195	St. George's College, Aruvithura	MGU	Chemistry	Academic Research Institution
196	St. George's College, Aruvithura	MGU	Chemistry	Academic Research Institution
197	St. George's College, Aruvithura	MGU	Chemistry ,Forestry	Academic Research Institution
198	School of Computer Sciences, M.G. University	MGU	Computer Science	Academic Research Institution
199	School of Environmental Science, M.G. University	MGU	Environmental Studies, Microbiology	Academic Research Institution

200	College of Fisheries Panangad	MGU	Fisheries Sciences	Academic Research Institution
201	Gandhigram Rural Institute	MGU	Home Science	Academic Research Institution
202	Centre for Mathematical Sciences, Pala	MGU	Mathematics, Physics	Academic Research Institution
203	Bharath Matha College, Thrikkakkara	MGU	Applied Mathematics	Academic Research Institution
204	Medical Mission, Kolencherry	MGU	Microbiology	Academic Research Institution
205	School of Bio Sciences	MGU	Microbiology	Academic Research Institution
206	Sree Sankara College, Kalady	MGU	Microbiology	Academic Research Institution
207	K.E.College Mannanam	MGU	Physics	Academic Research Institution
208	St. Pauls College, Kalamassery	MGU	Physics	Academic Research Institution
209	Cochin College	MGU	Physics	Academic Research Institution
210	School of Pure and Applied Physics, M.G.U	MGU	Physics	Academic Research Institution
211	New Man College, Thodupuzha	MGU	Physics	Academic Research Institution
212	MGU , Cheruvandoor Campus	MGU	Pharmaceutical	Academic Research Institution
213	Dept. of Pharmaceutical Sciences, Cheruvandoor	MGU	Chemistry Pharmaceutical Science	Academic Research Institution
214	School of Behavioural Sciences, M.G. University	MGU	Psychology	Academic Research Institution

215	Chinmaya International Foundation, Kochi	MGU	Psychology	Academic Research Institution
216	Marthoma College for Women, Perumbavoor	MGU	Zoology	Academic Research Institution
217	SNM College, Maliankara	MGU	Zoology	Academic Research Institution

