REPORT OF THE ITI REVIEW 2015-2020 by NASTEC

The NASTEC engaged the review team to conduct an institutional review of the Industrial Technology Institute as empowered by the Science and Technology Development Act No. 11 of 1994. The review was conducted from Nov 2020 to Feb 2021 during the Covid-9 epidemic. The review report presented here is an extensive study covering all aspects of management and operations at the ITI. There are 38 recommendations with comments and conclusions that can lead to substantive improvements in performance. Some ideas for new business model are suggested for gaining productivity and growth.

Dr. Chandra Embuldeniya
Prof. P.A. Paranagama
Ms. Sakunthala Tennakoon
REVIEW TEAM

ISBN 978-955-8630-23-5

REPORT OF THE ITI REVIEW 2015-2020 by NASTEC

Contents

List of Figures

Figures

List of Tables

Review Team.

By the powers of the Science and Technology Development Act No. 11 of 1994 vested in the NASTEC the Chairperson of NASTEC appointed the following committee to review the performance of ITI during the period 2015-2020. The NASTEC provided the team with a self-assessment report and a manual containing the items that should be looked into and presented with evidence, comments and an assessment.

Dr. Chandra Embuldeniya - Review Team Leader

He is a business leader with hands on experience in driving transformation and innovation in many sectors. His industry experiences covered primary Aluminium production, Dry cell manufacturing, Software Development, Data analytics, Marketing, Hitech Agriculture Development, Higher Education, and Business Process Reengineering. He is a senior management consultant and an expert in a multiplicity of disciplines that combines his business acumen with development. He was the first private sector personality invited by the government of Sri Lanka to set up a national university and founded the Uva Wellassa University and currently served as the Chairman of the Expert Committee to study the feasibility of the national Sports University. He was the first Vice Chancellor of Uva Wellassa which was founded on the STEAM concept for value addition to the national resource base. He introduced entrepreneurial education in Sri Lanka and interdisciplinary education for the first time in a Sri Lankan national university in 2005. He Chaired the National Chamber of Commerce, BIMSTEC Business Forum, the BIMSTEC Chamber of Commerce, Joint Business Forum and led several private sector companies.

Prof. (Mrs.) P.A. Paranagama - Review Team Member

She is the Chair of Chemistry and a Senior professor, University of Kelaniya and currently she serves as the Director, Institute of Indigenous Medicine, University of Colombo. She is a natural product chemist who is involved in research on value addition of spices, essential oils and indigenous medicine. She was the former president of Institute of Chemistry Ceylon. She is a fellow of Institute of Chemistry and a Chartered Chemist (CChem), Royal Society of Chemistry. She also serves as a member of the Executive Committee of Commonwealth Chemistry. She is the Chairperson of the Formula Committee of Department of Ayurveda and Vice Chairperson of Ayurvedic Medical Council. She is a recipient of several national and international research grants and awards. She has published over 54 research papers in indexed journals, written or edited 11 books / book chapters and published over 120 communications. She has successfully supervised over 21 postgraduate students. She has experienced in participating program reviews in several universities in Sri Lanka.

Ms. Sakunthala Tennakoon - Review Team Member

B.Sc. Sp. (Hons), M.Sc. (UK), Fellow IChem. C.Chem.

Retired Government Analyst with 33 years of experience in the Government Analyst Department. Pioneered the establishment of a new Digital Forensic Laboratory in the department. Obtained ISO 17025 Accreditation status to all the laboratories in 2016, being the first government department to receive the accreditation status. Member of several nationally important committees including special committee on amending the Criminal Procedure Code and Penal Code, visiting Lecturer for state university Master's degree programmes and author of publications in peer review journals in the fields of Forensic Toxicology and Pharmaceutical Analysis. Local and international award winner in above fields including "Zeneca Pharmaceutical Award" for the most meritorious student for M.Sc. in Pharmaceutical Analysis (UK) in 1993. Technical Assessor, at Sri Lanka Accreditation Board. Currently serving as Sector Specialist (Institutional Reforms), Ministry of Justice.

ITI Addresses.

Industrial Technology Institute, 363, Bauddhaloka Mawatha, Colombo 07.

Industrial Technology Institute, Vidya Mawatha, Colombo 07.

Industrial Technology Institute ,Modern Research and Development Complex, Malabe.

NASTEC Address.

National Science and Technology Commission (NASTEC).

6th Floor (Wing D), Sethsiripaya, Battaramulla 10120.

Abbreviations.

4IR-4th Industrial Revolution

ADG R&D-Additional Director General-Research & Developments.

ADG TEC Serv-Additional Director General-Technical Services.

ADG A&O-Additional Director General-Administration & Operations.

Admin, Finance, etc-Administration & Operation Division.

BOD-Board of Directors.

BOM-Board of Management.

BTU-Biotechnology Unit.

CHAIR OFF-Chairman's Office.

CML-Chemical & Microbiology Laboratory.

CP-Contract Projects.

CU-Computer Unit.

DG-Director General

DG OFF-Director General's Office.

ERP-Enterprise Resource Plan.

ES Engineering Services.

ETL-Electro Technology Laboratory.

ETS-Environment Technology Section.

FIN-Finance Department.

FTS-Food Technology Section.

General Industrial Technology Institute.

HR-Human Resources Department.

HTS-Herbal Technology Section.

IML-Industrial Metrology Laboratory.

IA – Internal Audit

INT AUDIT-Internal Audit Section.

ISC-Information Services Centre.

LIMS-Laboratory Information Management System.

LRP-Laboratory Resource Planning.

MKT-Marketing & Business Development Department.

ML-Materials Laboratory.

MTS-Material Technology Section.

NASTEC-National Science and Technology Commission.

OEM – Original Equipment Manufacturers

Others-Information Services Centre & Quality Assurance Department.

PT-Proficiency Test

PU-Purchasing Unit.

PU3-Purchasing Unit 3

QAD Quality Assurance Section.

R & D-Research & Development Division.

RAL-Residue Analysis Laboratory.

SLAB-Sri Lanka Accreditation Board.

STORS-Stores.

SUPPLES-Supplies Department.

TMU-Technology Management Unit.

TRANSPORT-Transport Unit.

TEC Serv-Technical Services Division.

TVEC-Tertiary Vocational Education Commission.

VPS-Vistas of Prosperity and Splendour.

ITI REVIEW 2015-2020 by NASTEC

Purpose of Review.

National Science and Technology Commission (NASTEC) is mandated by the Science and Technology Development Act No. 11 of 1994 to review and monitor progress of institutions such as ITI and other similar science, technology and research focused institutions within the purview of the Act. This report is the outcome of such a review of ITI for the period of 2015 to 2020 conducted by a team appointed by the NASTEC.

NASTEC clearly defined the purpose of this review as follows in the Review Manual.

- To obtain information on how to improve activities of the institution.
- To induce a self-reflection by the scientists on the results and outcome of S&T activities, the way they are performed leading to strategic orientation towards the desired goals.
- To assess effectiveness of the activities.
- To encourage good management of S&T institutes.
- To improve internal and external transparency.
- To recommend future resource commitments.
- To gather information for policy change.
- To inform the stakeholders about the institutional competencies.

The report is extensive and consists of an Executive Summary, Introduction, Management Assessment, Output Assessment, Revenue and Expenditure Analysis (perspectives of the institution, between divisions, within divisions), Equipment Value Analysis, Customer Value Analysis, Customer Survey, Human Resources (perspectives of revenue generation, space allocation, equipment available), Opportunities presented in the Vistas of Prosperity and Splendour, Scientific and Research Publications, Funded Projects (an analysis by the durations, sources, funding areas of specialization), and Avenues of Expansion. It is rounding up with the comments, conclusions, and recommendations. The annexes are given at the end.

Executive Summary.

ITI (originally CISIR) is the premier technology research and development institute of Sri Lanka set up by our forebears to cater to rapidly changing industry with the most innovative and modern technology inputs with the aim of keeping Sri Lankan industry abreast with the competitive demands. ITI was set up in 1998 during the third industrial revolution as a going concern continuing from the CISIR beginnings in 1955. CISIR came at the transition from first industrial revolution to the second industrial revolution and many large factories were set up in keeping with the industrial revolution. As an organization that should adopt technology in an illustrious manner, we find the following industrial age remnants still operating at the ITI - working in functional silos, arm's length transactions with customers, low cost standardized products and services, perceived long product life cycles, white collar manager and blue collar workers, traditional financial accounting, and manual operations from the laboratory to the information desk. Whereas when we talk about a premier technology research institute in the digital age which should have cross functional business processes, closer relationships for creating greater value to customers, assisting integrated raw material supply, assisting production and delivery based on customer orders, customized services and products even for small orders without loading additional costs, catering to global customers with equal sensitivity as for the domestic customers, knowledge workers, and new strategic management tools[1]. This is not the industrial age and thus to get away from that mindset we propose to have a new customer value proposition with better internal processes geared to deliver value to customers and the right set up of a learning and growth organization, strategically linked up, through sustained growth and productivity themes, to generate profitable financial performance, and culminating in realizing the vision of the enterprise. Having said that we do not fail to mention here that the ITI has capable personnel to deliver the government expectations through a restructured arrangement.

The net result of the outdated[2] operational mechanism at ITI consequently has brought a burden to find support from outside including the government for grants instead of working on high value projects targeting market segments and capitalizing on opportunities arising in the market. Investors find technology one of the best investments provided the technology products are patentable demand driven, futuristic and market oriented.

ITI is rich in physical assets and some are very expensive. It is even richer with intangible assets. We believe the value of intangible assets at the ITI is many folds more than physical assets. As such we were exploring to determine a robust strategy that connects the

---

1

(a) Raw material supply, manufacturing and product delivery based on customer orders....-These activities are not in the ITI mandate and ITI only provides technology or testing services to industries. The statement is intended to thrust changes in the policy (according to the TOR given by NASTEC) so that ITI can project a far superior service profile to potential customers in the face of the 4IR.

2 Outdated in relation to the 4IR needs.

intangibles with the tangibles to deliver the fiduciary responsibility without being a burden on the government. There were no evidence of such an active strategy during the review period 2015 to 2020[3]. In fact, during the three years 2017-2019, ITI has been without any strategy which can spell disaster. Readiness of HR, information and technology capital, and organization capital are the intangibles. The liquidity of short term assets (inventory and receivables), and long term assets (equipment, property and goodwill) are the tangibles.

The incapacity of the ITI to plan and execute a strategy to recover their spending was revealed when evaluating the ITI's management practices. The net outcome was more than one third of the practices classified weak. This is a systemic deterioration of the institute which now has to return with a robust new strategy with thinking to suit the 4IR. The financials have revealed this beyond doubt and is extensively addressed in this report.

The variables that we had access to in detail have been analyzed to present their outcomes from the causal to outcome impacts. From our observations and analysis of the five years ending 2020 November it seems that only three sections have been able make 100% recovery of their costs. It is however not clear if the investments have been paid for by the revenue. As a government organization engaged in commercial activities, we did not find conclusive evidence of having done ROI analysis satisfactorily. It means that the feasibility of new equipment purchases and matching the outcomes after purchase with that of the feasibility study has failed. Some of the very expensive equipment purchased by the institute for several labs have not been shown on the basis of a payback.

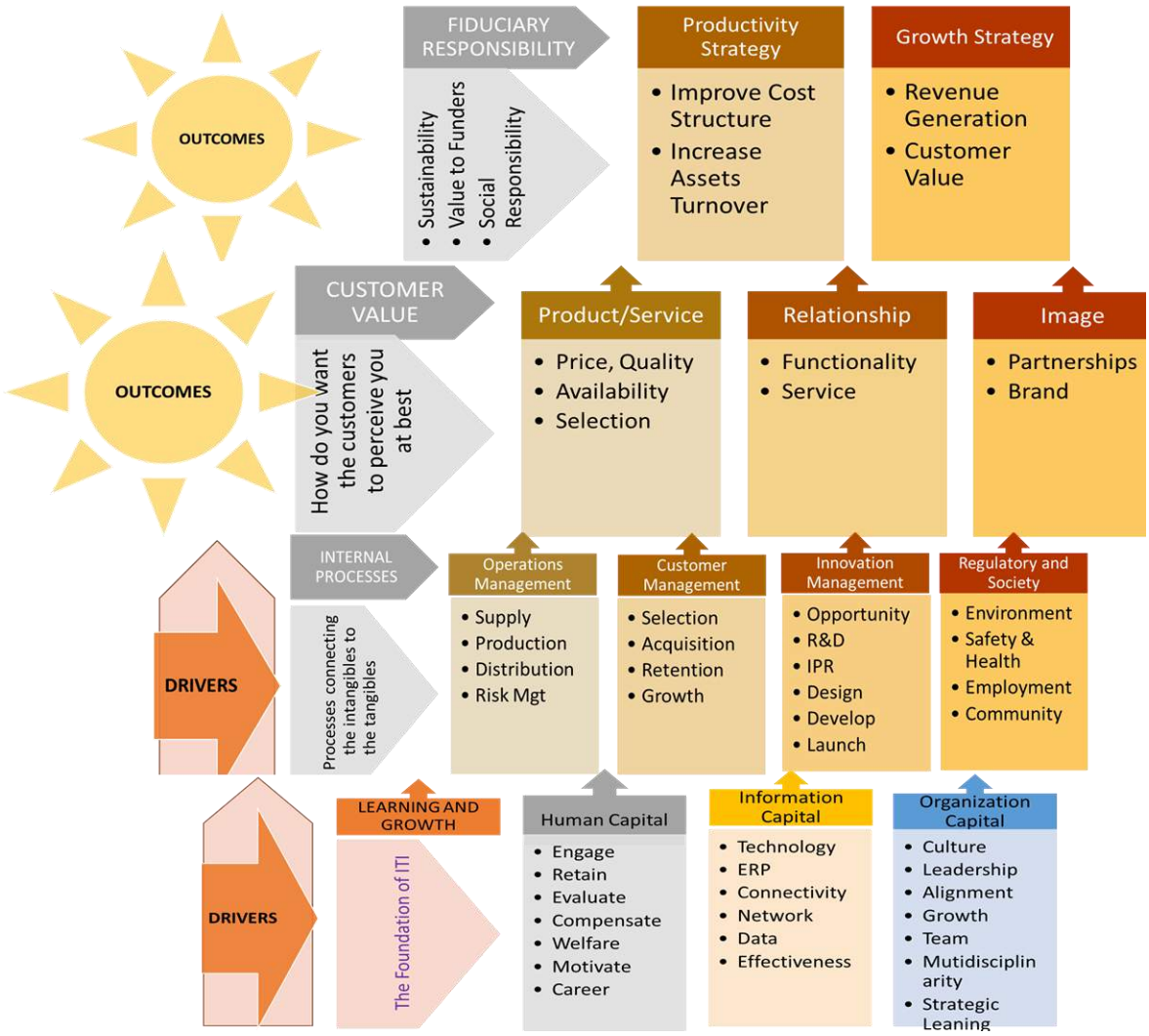
There is a complaint about not having sufficient HR to fill the jobs vacant at the ITI. It may be necessary to do a complete organizational restructuring before any recruitment is affected. The restructuring should be to focus on the business opportunities in the market and not to facilitate the survival of the failing operations. A robust strategic map of the ITI is presented below as we could understand. It connects the intangible assets with those tangible assets. The ITI should strengthen the DRIVERS of major OUTCOMES. The foundation of ITI is with the human capital, information capital and the organization capital. These are the intangible assets. In restructuring ITI we have presented some insights in the body of this report.

Currently the human capital should be reorganized and developed into working on job families that can drive for success in delivering customer value. Delivery through the indicated processes is hard unless the information capital is strengthened by adopting modern digital technology. The processes are driven with the expensive equipment currently having no such information generation. The management from top down should know how best machine time should be distributed more productively. The innovation management process has to be strengthened in many places such as identifying opportunities, R&D, IPR, design, develop and launch. Customer management has many functions that need relooking and strengthening. The profitability of the customers have to be well managed. When considering operations management, we have seen it had broken down at HR and finance management level due to issues that we do not have full information. At customer value creation there is much to be

[3] There was no strategic plan between 2017 to 2019, three years.

done to elevate recognition. Even though ITI has gained accreditations and rewarded on many occasions the ITI feels that the customers do not label their innovations cobranding with ITI. Information from customers are used only annually for maintaining conformity with certificates. However, corrections are not seen to be brought about immediately.

Figure 1: A Strategy Map for ITI



The fiduciary responsibility of the ITI is to the government, the main funding body. The government is bridging the gap in finance to the extent of nearly 50%. The recovery level of expenditure in many sections are well below 100%. It will be very hard to recover overheads at the present rate of operations and thus need a restructuring plan.

The Tech Services Division though having much room improvement by far the most productive at ITI. The R&D Division has failed in recovering the investments in the labs under their supervision. A suggestion presented here is to bring together the Research Scientist and the Technical Officers under one category of jobs and keep all the labs under the present Tech Services. In this arrangement Tech Services will plan and execute a strategy to make all labs break even. The R&D officers have to plan their research and obtain services of the machines for their research on a machine time basis which will get accounted in the books. It is also

important to account for time management of officers who attend many external meetings by invitations.

The report contains extensive analysis showing the outcomes of the ITI with 83 figures and 61 tables. The figures give valuable information to understand the situation within ITI. The revenue analysis is comprehensive and should be an eye opener. The analysis of human resources, laboratory equipment, and laboratory space are equally very important. Finally, we added to this report some opportunities that ITI can capitalize on by the government policy stated in the Vistas of Prosperity and Splendour. The ITI should restructure and it requires new areas for expansion into modern science and technology. There are some inspired ideas presented in the end.

There are several areas for the policy makers to consider from this review to enable ITI (and similar technology institutions) to deliver outstanding performances to satisfy the needs of technical services, technology, and research and development. Such policy changes have been encouraged in the NASTEC TOR given for the ITI review.

When we presented the first draft to the ITI, it became clear to ITI that they have not been consistent in their reporting and have missed out on providing accurate verifiable data and information on many areas. We have taken their new suggestions into consideration and wherever possible added them to the report. However, this is a report of the performance during the period 2015-2020 Nov based on the authentic evidence presented to us in the SER and the annual reports. The evidence that we could verify was examined during our rounds of visits to the ITI and what we had not been able to find then is not taken into consideration here. The review team has taken data that could be authenticated but not data claims.

Introduction.

Very Brief History (CISIR to ITI).

Industrial Technology Institute (ITI) was established on 1st April 1998 by Science and Technology Development Act No. 11 of 1994 (hereinafter referred to as the Act) as a successor to the Ceylon Institute of Scientific and Industrial Research (CISIR), which was established in 1955. Industrial Technology Institute (ITI) is a statutory board. ITI is a government owned multidisciplinary R&D institution, which aims to conduct demand driven R&D and internationally competitive technical services according to the Act. Hence, the vision of the institute is to be a center of excellence in scientific and industrial research on national development while the mission is to conduct innovative R&D and provide internationally competitive technical services to accelerate the industrial development for the benefit of Sri Lanka.

Statutory Act Relevant to ITI & Mandate of ITI According to the Act.

The Science and Technology Development Act (No. 11 of 1994) - Sect 18 empowers the ITI. The sub section “Objects and functions of Technology Institute” under the same section clearly highlights the purpose and the set of functions that ITI should engage in.

Procedure adopted for Performance review.

The NASTEC provided the Review Team with a clear Review Manual and a self-assessment report prepared by the ITI. The review manual is followed in this report while embarking on detail analysis for explaining the achievements and failures during the review period. The content in the Self-Assessment Report has been duly considered.

The review was conducted under trying conditions during the Covid-19 pandemic amidst statutory restrictions. The review team adopted online meetings with the relevant responsible officers of the ITI to get necessary feedback on their work. It also conducted site visits and inspections of all the laboratories and workspaces of the ITI while meeting virtually every officer working at the ITI. The review team visited Malabe, Bullers Road and Vidya Mawatha premises on several occasions. The review team requested the officials to submit data on review areas and most officials provided such data. The Director General and the Additional Director General facilitated the events and data collection well while all the heads participated in zoom meetings and some were present during inspection visits (Covid-19 was a hindrance for their physical presence on some occasions).

The review team held a Zoom meeting with a few board members from the board room of the ITI. The Chairman facilitated this meeting and he participated at this meeting from his office at Malabe.

General overview of different Divisions.

ITI consists of three major divisions, Technical Services Division, Research and Development Division and Administration and Operation Division, and two supporting departments, Quality Assurance Department and Information Services Center. Let us take you through the breadth of ITI being the premier S&T Research organization in Sri Lanka. It has Food Technology Section, with laboratories designed for Cereal technology, Food microbiology, Fish

processing, Fruit and vegetable processing laboratory, Nutrition and Functional food, Postharvest technology, Sensory and shelf life testing, Food Analysis, and Pilot plant facility. The Herbal technology Section is equipped to handle Natural products chemistry, Microbiology, Pharmacognosy, Bioactivity, Organic substances, Essential oil, Spices and Essential oils, Medicinal plants, Cell culture, Tissue culture, Herbal based product development, and an Herbal Pilot plant facility. The Material Technology Section consists of Chemical, Ceramic, Pilot plant, and Instrument laboratories. Environment Technology Section has expert areas of Industrial Pollution Control, Environment Management, Energy management, Air Dispersion Modeling, and Risk Assessments of Chemical Leakages and Spillage. The Biotechnology unit has well equipped laboratories in Biotechnology, GMO, and Pathogen testing. The Chemical and Microbiological Laboratory has expertise for Cosmetic testing, Agro and Food Product Testing, Microbiology, Organic, Water and Wastewater Testing, Fertilizer and Soil Testing, and Pharmaceutical Testing. The Residue Analysis Laboratory consists of Organic Residue Analysis and Inorganic Residue Analysis. There are Electro Technology, Industrial Metrology, Materials, Construction Material Testing. The Material Laboratory has Chemical Analysis, Rubber, Plastic and Footwear Testing, Wood and Cellulose Testing, Packaging Material Testing, and Petroleum and Lubricant Testing.

ITI is Newly establishing laboratories for Packaging testing, Pharmaceutical testing, Petroleum and Lubricant testing, GMO testing, and Herbal and a Biotech Pilot Plant.

In the opinion of the senior management at ITI all laboratories are fully utilized to fulfill the customer demand for technical analysis, research, and development projects. The question arises if they are fully utilized then why is it that they do not generate enough revenue to sustain the operations.

The laboratories of Chemical and Microbiology testing, Residue Analysis, Material testing, Industrial Metrology and Electro-technology testing of the Technical Services Division are ISO 17025 accredited for testing and calibration. This division has started conducting Packaging testing, Lubricant testing and Pharmaceuticals testing.

The R&D Division consists of Food Technology, Herbal Technology, Materials Technology, Environmental Technology and Biotechnology areas with ISO 9001-2015 certified laboratories. The R&D division of ITI conducts GMO (genetically modified organism) testing with China – Sri Lanka collaborative biotechnology center facilities. GMO testing is done at the newly developed laboratory in the Biotechnology Unit. A new biotechnology R&D complex was established in Malabe in 2017. Food Technology and Herbal Technology are located in Malabe. The administration staff are currently located in Malabe.

The ITI has undertaken many R&D projects in different disciplines including food technology, herbal technology, biotechnology, material technology, environmental technology, chemical and physical sciences during the period of 2017 to 2019 and 50% of the projects were completed with successful outcomes while some are ongoing (see Annex 2 & 3 for completed and ongoing projects). Some of the technologies developed through R&D and Contract

Projects are transferred to interested industries and these products are available in the local and export markets (Technology Transfers and Methods Transfers[4]).

Some of the technologies developed and commercialized won 23 national awards. There have been 2 in 2015 and 3 in 2016 that started and later won 23 awards and gained recognitions. The scientists who publish their research in high impact journals received Presidential Awards. The new test methodologies established and validated through the research are being used in ITI technical services. As a reputed multidisciplinary R&D institution of the country, ITI has contributed by assisting in solving problems at national level (see Annex 6 for Awards details).

While having such a self-esteem it is necessary for ITI to connect the value it creates in all aspects of outcomes as shown in the strategy map. If the institution has a habit of conducting services free of charge to customers then it is a bad practice unless it has an indirect value that will flow in monetary terms but should be accounted. There should be a mechanism to value such services as attending important meetings and the time spent on such committees too. This aspect has to be looked into. We like to quote Mr. Elon Musk from what he said recently – "a company has no value in and of itself. It only has value to the degree that it is an effective allocator of resources to create goods and services that are of a greater value that the cost of the inputs"[5]. This has been stated many times by management professionals and we endorse it for the benefit of ITI. It is now time for the ITI to change.

Organizational Structure.

See Annex 4 for the complete organization structure.

The ITI has seven main functional areas of work according to figure 2. Altogether there are fourteen activities identified in the self-assessment.

Table 1: Activity Areas of ITI

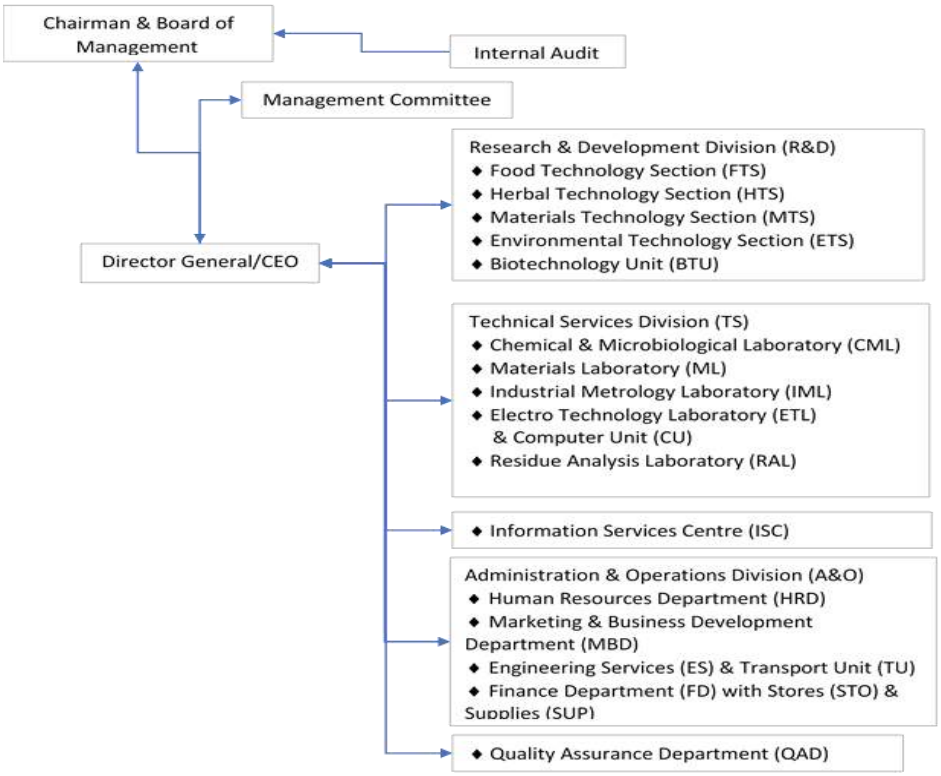
No	Activity
1	Research
2	Development activities
3	Analytical services
4	Consultancy services
5	Quality assurance services
6	Laboratory accreditations
7	Instrument calibrations
8	Environment hazard monitoring
9	Science popularization
10	Facilitating R&D activities
11	Funding S&T activities

[4] There have been 2 in 2015, 1 in 2016, and 3 in 2018, Technology Transfers, and 2 in 2016 under Methods Transferred Inside.

[5] Elon Reeve Musk FRS is a business magnate, industrial designer and engineer. He is the founder, CEO, CTO and chief designer of SpaceX; early investor, CEO and product architect of Tesla, Inc.; founder of The Boring Company; co-founder of Neuralink; and co-founder and initial co-chairman of OpenAI (Wikipedia). His net worth: US$ 209 billion (January 2021) is the richest person in the world.

12	Information dissemination
13	Research recommendations
14	Other – Advisory services, editorial committees, curriculum development etc.

Figure 2: Simplified Organization Structure – Seven Major Areas.



Objects and functions of Technology Institute.

Under Section 18 it states that "The Technology Institute shall be demand driven. The object of the Technology Institute shall be to elevate the level of technology in Sri Lanka to the level required for rapid industrialization and in furtherance of this object, its, functions shall be -.

(a) to support industry by.

(i) undertaking on contract, testing, investigation and research, for improving product quality technical processes and methods used in industry, and for discovering new processes and methods to be used in industry.

(ii) providing technical services and consultancies of and,

(iii) engaging in activities connected with technology transfers, the adaptation of technologies and the development new technologies.

(b) to conduct research with a view to accelerating industrial technology development.

(c) to collect, process, and disseminate useful technical information, in particular on 'shelf technology' with a view to accelerating industrial development.

(d) to undertake training of persons in areas related to the experience of the Technology Institute.

(e) to undertake or to collaborate in the survey and monitoring of environmental pollution and to recommend remedial measures to mitigate such pollution.

(f) to co-operate with government departments and institutions universities technical colleges and other bodies in demand driven research to promote industrial technology development."

Thus, the Science and Technology Development Act clearly positions the ITI for a major role in the development of Sri Lankan economy.

The activities to be undertaken by the ITI based on the strategic plan connected with the Vistas of Prosperity and Splendour has estimated the thirteen programs/activities are requiring investments up to Rs7778.1mill.

In the following evaluation as specified in the Evaluation Manual note that the Level of Practice (Performance Indicators) are marked either: Strong, or Moderate, or Weak.

Management Assessment.

The following is a predetermined set of Management Practices by NASTEC that required Comments/Evidence of the Review Team with the judgement given by a categorical variable for the Level of Practice. The variable is nominal indicated by “Strong”, “Moderate” or “Weak”. The results are given below.

Institutional Response to External and Internal Environment in Planning.

Institutional response to external and internal environment in planning organizational strategy	
Management Practice	The organizational mandate (as specified by the relevant Act) is considered in strategic planning
Level of Practice	Weak
Comments/Evidence	There was no strategic plan under operation 2017-2019, which covers three years of the 5 year review period. ITI is proposing to establish a new business centre. Hence, individual section is instructed to prepare their own business plan. SDD finance is given the responsibility to prepare the business plan and present to the board to inform the current status of each section. SDD finance is also requested to propose strategies how to improve the income in each section.
Management Practice	The institution is responsive to changes in Government policies and strategies
Level of Practice	Moderate
Comments/Evidence	Dr. Athula Perera, a member of the Board of management has been appointed to look into this matter. ITI has already taken initiatives to support the government policies and make changes as per the National Policy Framework, vistas of prosperity and splendour. The review team has listed all opportunities available to ITI under the Vistas of Prosperity and Splendour.
Management Practice	Factors such as strengths, weaknesses, threats and opportunities are considered in strategic planning
Level of Practice	Moderate
Comments/Evidence	Strengths are identified by ITI management and given below.

a. Infrastructure.

- **Well-equipped accredited laboratories.**
- **State of the art modern R & D complex with incubation and scaling up facilities.**
- **high-end analytical instruments.**
- **All Testing laboratories are ISO 17025 and ISO 17043 accredited.**
- **All R &D laboratories are ISO 9001 : 2015 accredited.**

b. Recognition.

- **Internationally recognized state-owned R & D institute.**
- **Internationally recognized accredited testing and calibration services.**
- **Accredited PT Provider.**
- **Internationally recognized training centre.**
- **Recognized technical advisor /consultant for industrial development and environmental sustainability.**
- **Recognized / Approved Laboratory Government organizations.**
- **International collaborations with WAITRO, INBAR, UNIDO, PTB etc.**
- **Centre of excellence of COMSATS, Sri Lanka.**

Clientele.

- **Wide range of customers including international companies, SME, Government Organizations, Regulators, Universities, etc. (A customer analysis is given in the report with details. It has taken a sample survey as well as the existing transactions data into the analysis).**

Weaknesses.

- **Inadequate Autonomy.**
- **Inadequate autonomy for smooth/efficient functioning of projects.**
- **No advanced facilities for customers – credit facilities, accepting samples and delivering reports to their doorstep.**
- **Progress of the samples submitted for testing cannot be monitored by the customers due to poor networking facilities.**

Human Resources.

- **Stakeholder feedback is not taken to improve the quality/standard of the work perform at ITI.**
- **HR involved in marketing section is not properly addressed the facilities/ products/ technologies developed in order to increase the generated funds of ITI.**
- **Most of the higher positions cadres are vacant.**
- **One-person cover duties of 2 or 3 cadre posts.**
- **No flexible working hours or shift base working system.**
- **Most of the RT /ART are overqualified and most of them are degree holders or degree with PG qualifications.**
- **Brain drain, Retention of qualified trained staff due to lack of motivation scheme.**

Infrastructure.

- **Malabe land is underutilized.**

- **No facilities developed for pilot scale engineering research.**
- **No functional Technology Transfer Unit.**
- **Inadequate ICT facilities and need to upgrade to reach new technology used in other research institute in foreign countries.**
- **Lack of proper costing system for technology / consultancy/ Contract projects etc.**
- **Lack of proper mechanism to identify industry needs / technology transfer /Technology Marketing.**
- **Delays in decision making and implementation.**

Funding.

- **Inadequate generated funds.**
- **Inadequate government funding and not timely released.**
- **Inadequate investments by industries on R & D.**

Opportunities.

- **Large number of stakeholders to improve the business at ITI and strengthen the generated funds.**
- **Increased demand for technical services related to conformity assessments and regulatory bodies.**
- **Increase demand for R& D Innovations.**
- **International collaborations with foreign countries.**
- **Increase international market demand for innovative technologies / import substitutions.**
- **sustainable development goals in place.**
- **Vistas prosperity - National Policy Framework.**
- **Bilateral S & T agreements.**
- **Upgrade Pilot scale facilities to incubation for SMEs.**

Threats.

- **Emerging private sector accredited laboratories.**
- **Fast changing technology.**
- **Low growth rate in manufacturing industries.**
- **Job opportunities for ITI trained staff in private and public sector.**
- **Competition among testing laboratories.**
- **Frequent changes in policies due to external factors**

Management Practice	Stakeholders needs are taken into consideration in strategic planning
Level of Practice	Weak
Comments/Evidence	No regular stakeholders meetings conducted to get the feedback. This report has a customer survey and hints at certain weaknesses while recognizing the strengths.
Management Practice	The Board of Governors is involved in strategic planning

Level of Practice	Moderate
Comments/Evidence	There was no Strategic Plan during the period 2017-2019. Now It is discussed at the board and a plan been developed for 2020 to 2024.
Management Practice	The extent to which staff members are involved in strategic planning
Level of Practice	Moderate
Comments/Evidence	Mainly top management are involved in preparation of strategic plan. It is proposed to take feedback from all levels of employers at ITI as well as stakeholders. There are many cross selling opportunities not taken into consideration by the ITI due to silo based operations.
Management Practice	Government allocations and alternative funding opportunities (donor funding) are considered in strategic planning
Level of Practice	Moderate
Comments/Evidence	Not addressed properly. The dependence on state for bridging the gap in spending is ever present. Capital and recurrent grants received from 2017 to 2019 are given. Other income is stated when compared to TG grants was a very small number. An analysis of the funding with sources of funding, where these funding is spent, etc are given in the report.
Management Practice	The extent to which policies and plans of the organization are reviewed and updated
Level of Practice	Moderate
Comments/Evidence	Internal committee appointed from ITI staff has decided on the policies and plans of ITI. It was revealed that costing and marketing were done by the internal staff without consulting external experts. SDD finance was involved in costing and pre-prepared charts with costing information were available at ITI to calculate the cost of each type of product / technology. ITI has now identified the weakness of the existing method of costing. The costing has never taken into account the expenditure differentiated by the customers' needs and therefore every customer seems to be charged the same price. From the year 2020 it has been decided to change and proposed to establish a business centre as a new concept to increase the generated funds. A separate committee has been appointed

	including the Chairman, DG, two board members and some external members. This committee is going to select the costing, suitable industry and the nature of advertisement etc. Planning to streamline technology transfer, testing and another research. However, this is still under discussion.

.

Planning S & T Programs and Priorities.

Planning S & T Programs and Priorities	
Management Practice	National development goals are considered in planning programs & setting priorities
Level of Practice	Strong
Comments/Evidence	Testing and research projects carried out at ITI contribute to the national development of the country and address the national policy framework. The average per year is about 5-6 projects and should seriously consider if this is an adequate contribution. The following is given by the ITI management.

Ministries, Industries, Universities, Departments, Statutory Bodies and other S&T organizations consult ITI to address the national issues. .

ITI contribute to following national projects during 2017 to 2019.

1.Noise & Vibration monitoring and Noise Modeling in Central Expressway Development Project.

2. Environmental monitoring of Bandaranayke International Airport Development Project Package B Phase 2.

3. Metro Colombo Solid Waste Management Project.

4. Baseline Environment Audit for the Industrial Estates.

5. Development of Hazardous Waste Inventory of Sri Lankan Industry Sector.

6. National inventory of Mercury release in Sri Lanka, Final report 2016.

7. Monitoring of water quality of schools in Sri Lanka.

8. Upgrading existing food industries / entrepreneurs by introducing proper technology.

9. Analysis of heavy metals in ground water.

10. Monitoring and analysis of PCB.

11. Identification of synthetic rice.

12. Hazardous Compound identification in Grade 7 Geography Textbook.

13. Determination of the quality of palm oil from market.

14. Establishment of analytical testing service for MCPA residues in tea. **15. Investigation on the inferior quality milk powder stock at a local Milk powder factory.** **16. Recommendation on safe fruit ripening technology**	
Management Practice	Board of Governors participate in planning and priority setting of program
Level of Practice	Moderate
Comments/Evidence	From 2018, members of the board of management participate in setting of program and former Chairman is a member of the committee appointment to establish the business centre. Board members are involved in evaluation and monitoring project proposals. The committee working on strategy should consider having more external members who have the experience to think from a global perspective. The business plan focusing on setting up a business centre is one of the strategies but it should not be the wholistic strategy or a panacea.
Management Practice	The extent to which the staff of the institution participate in programme planning and priority setting
Level of Practice	Moderate
Comments/Evidence	SDDs have to prepare the annual plan of work and first present to the staff of the section and get the feedback. Then it is presented to the management committee in order to get the committees opinion. Finally present to the board of management to get the board approval. Year after year there has not been new thinking to become self-sustaining. That is a much bigger thrust than the SDDs annual work plan based on the previous years' experiences to cover mostly the recurrent expenses while leaving the overheads untouched. See the revenue analysis given in this report.
Management Practice	The extent to which programmes are planned and approved through appropriate procedures
Level of Practice	Strong
Comments/Evidence	The management committee identify the financial and nonfinancial targets. When identifying financial targets, SDDs have to look into the behaviour of earning during last five years. Then decide the financial target for the current year and incorporated into the annual programmes in order to obtain the board of management approval. See the comments

	immediately above. This is an unsatisfactory procedure to engage with more revenue generating opportunities in the marketplace. The correct approach should be to consider at least the full cost of operations as at present and generate propositions to recover the full costs with new strategies.
Management Practice	Stakeholder interests are considered in programme planning
Level of Practice	Weak
Comments/Evidence	Stakeholder consultation for program planning is in very poor state.
Management Practice	The extent to which the availability of funds (government allocations and other funds) generating funds are taken into consideration in planning programmes
Level of Practice	Moderate
Comments/Evidence	SDDs have to achieve the financial and nonfinancial targets given in the program. Technical services have to improve their services through increasing number of customers. The report gives a thorough analysis of the recovery % (in relation to the total revenue as well as the contribution within the division/section). It shows that
Management Practice	The obtaining of necessary equipment is considered in planning programmes
Level of Practice	Moderate
Comments/Evidence	Priority has been given to purchase essential equipment required for the annual program. The laboratories are well equipped with very expensive electronic equipment. These equipment need to be made more productive organization wide. It could only be done with digital approaches to resource planning which ITI has failed to achieve so far.
Management Practice	Stakeholders are represented in the institution’s planning and review committees
Level of Practice	Weak
Comments/Evidence	Poor communication with the stakeholders and poor responsiveness to their latent needs from a business development point.

Management Practice	The extent to which socio economic and commercialization of aspects are considered in programme planning
Level of Practice	Moderate
Comments/Evidence	The testing services and R&D sections of ITI play major role in contributing socio economic and commercialization of products. Testing export products such as tea, fruits and vegetables. ITI also involved in testing products imported to the country in order to import products to check the suitability, restricting unauthorized and unsuitable goods. R&D section mainly conducts research on identification new technologies and products developed. Technology transfer is expected in helping to develop entrepreneurship. Most of the technology transfer promotes the use of local raw materials like vegetables, fruits, fish creating job opportunities and enhancing the living standards of the rural community and hence the economy of the country. The technology is also offered to initiate cottage industries like manufacturing detergents, cosmetics, joss sticks using local natural raw materials assisting the SMEs. ITI also conduct research on the value addition to our natural resources, e.g., graphite, medicinal plants etc. could retain/draw foreign exchange to the country. ITI has so far not assessed their socio economic impact. The appearance of the wide portfolio of activities is impressive but does not address the key functions of commercializing. The commercializing value chain has many gaps at the ITI which will be discussed elsewhere in the report.
Management Practice	Effectiveness and efficiency of institutional procedures in approving new S&T programmes
Level of Practice	Moderate
Comments/Evidence	The board of management approves the S&T programmes after approval obtained from the management committee. The Management Committee and the Board of Management have a responsibility to assess the opportunity cost of the proposals by the heads and determine the most opportune and feasible projects that can yield best results for the ITI. These decisions require assessing a plethora of criteria and we have not seen such approaches.

Planning S & T/ R & D Projects.

III. Planning S & T/ R & D Projects	
Management Practice	The staff is provided with guidance for project planning
Level of Practice	Moderate
Comments/Evidence	Every year the thematic research areas are selected under the framework of corporate plan on the basis of Institute mandate, National issues, National needs, economic development requirements & also continuation of previous research projects etc. The Add. DG (R&D) call for the project proposals on the selected areas, each year and the principal investigator of the project in consultation with the project team and the guidance of the SDD's of the respective section prepare the project proposal. None of the researchers consider the time value and opportunity cost. Thus, the projects spend more than they are returning. All the researchers should get trained on this aspect.
Management Practice	Previous research results/data are used for planning projects
Level of Practice	Moderate
Comments/Evidence	Certain projects are continuations of the previous projects with additional goals. Projects on Cinnamomum zeylancium (Ceylon cinnamon, Cinnamomum verum), Kitul, Red clay filters and other products, Sri Lankan natural quartz etc are some of the examples. These projects have symbolic value as local resources being value added. However, it is not clear how the economic impact is measured. Have there been IPs that created wealth during these projects is not clear.
Management Practice	The extent to which the institution follows a formal process for preparation, review and approval of projects
Level of Practice	Strong
Comments/Evidence	The research Project proposals submitted are evaluated by a Research & Development evaluation committee comprising senior management team including the Chairman, Director General, Additional Director General (R&D), Additional Director General (Test services) and two members nominated from the board one from the Industry & the other one with subject

	Knowledge. Method of review is either through presentation or one to one discussion with the proposed project team. The project proposals are reviewed by this committee and marks are given according to a marking scheme. Based on the total marks suitable projects are selected and approved. The formal procedure should include economic criteria and measurable outcomes to be monitored.
Management Practice	The extent to which organizational plans (e.g., medium-term plan, corporate plan, strategy etc.) are used to guide project selection and planning
Level of Practice	Weak
Comments/Evidence	Cooperate and strategic plans are normally taken into account in project selection & planning by companies. There was no corporate plan to work on during the past two years at the ITI.
Management Practice	Multidisciplinary projects/ activities are encouraged by the institutions
Level of Practice	Weak
Comments/Evidence	We found several projects multidisciplinary (Out of 65 projects only 7 were multidisciplinary projects). Further, 7.7% (5 projects) were multidisciplinary within the institution while 3.1% (02 projects) were International multidisciplinary projects. An analysis is presented in this report under a separate heading.
Management Practice	Foreign collaborations are encouraged and incorporated in planning.
Level of Practice	Moderate
Comments/Evidence	Under foreign collaborations there are 11 countries that collaborated on studies which includes Canada, China, India, Japan, Kenya, Korea, Pakistan, Philippines, Tanzania, Trinidad, and USA. Only Japan, Canada, India, Korea, Philippines, and USA have shown funding. The total value of the investment during the five years many be around Rs.100 million. The durations have been Korea 1-2Yr, Canada 1-5Yr, Philippines 1Yr, India 2-3.3Yr, Japan 2Yr, China 4Y, Pakistan 2-6Mon, and USA 6Mon. The start year and finish year are not given in the SER. There have been projects with Kenya, Trinidad and Tanzania but without any description of duration or expenditure. With the information available only the project with China is ongoing probably due to it being related to postgraduate work. There are projects labeled other international collaborations ongoing with

	China Germany and Pakistan. The outcomes of all these projects (IPRs, Commercial Value, etc) are not clear due to the SER not having necessary details.
Management Practice	Partnership with private sector is encouraged by the institution
Level of Practice	Weak
Comments/Evidence	There are many analytical works carried out for the private sector but those projects do not show any long term development except some may have been for regulatory purposes.
Management Practice	The extent to which development research/activities are considered in planning projects
Level of Practice	Moderate
Comments/Evidence	Most of the projects are research oriented and have 33 Journal papers and 151 Abstracts were published during 2013 to2018. See analysis in the report.
Management Practice	The extent to which basic research are considered when planning projects
Level of Practice	Weak
Comments/Evidence	ITI conduct less than 5% basic research in the R&D section and testing services. ITI is mandated to support industrial development and conduct basic research only where it meets with this purpose. In the assessment of ITI "ITI mainly conducts applied research but not basic research. When there is a need to collect baseline data ITI conducts some basic research and the percentage is less than 5% of their total R&D projects".
Management Practice	The degree to which adverse effects on environment are considered in planning projects
Level of Practice	Moderate
Comments/Evidence	18.5 % of the projects are on the study of adverse effects on the enviorenment.*
***The following projects address the adverse effects on Environment.** **I. Acoustic environment induced by background noise in classrooms of urban schools in Sri Lanka.**	

II.	**Microbial bioremediation of petroleum hydrocarbon contaminated soil & water.**
III.	**Reduction of vehicle exhaust emissions by nanoparticle supported adsorption media.**
IV.	**The evaluation of impacts of Agrochemicals on Grape tree cultivating soil and water; study of heavy metals, nitrates and phosphates.**
V.	**Determination of Cyanotoxins in surface waters of Sri Lanka.**
VI.	**Application of anaerobic digestion for the treatment of Poultry processing wastewater and determination of CH4and CO2 emission factors.**
VII.	**Development of live noise barrier blocks for outdoor sound proofing.**
VIII.	**Investigation of Calcium Magnesium and heavy metal uptake efficiency of Terminalia arjuna (Kumbuk tree) as a phyto-remediation species for water quality improvement of CKDU affected areas.**
IX.	**Determination of noise level and acoustic analysis of toys for children.**
X.	**Design of production process equipment and wastewater treatment plant for Graphene production process.**
XI.	**Study the distribution and quantification of microplastics and the accompanied pollutant assemblages in the aquatic environments in Sri Lanka.**
XII.	**Assessment of claims on intense accumulation of heavy metals; Hg in Puttalam lagoon followed by potential health implications and industrial contributions.**

.

Project Management and Maintenance of Quality.

IV. Project management and maintenance of quality	
Management Practice	The effectiveness of the procedures for resource allocation at different levels (organization, departments, program etc.
Level of Practice	Weak
Comments/Evidence	Need to consider fair distribution of resource allocation to different sections/Laboratories. Some laboratories have updated currently available high tech instruments while some laboratories struggle with the old instruments. For example, equipment purchased during 2000-2019 is only 40.8% compared to those purchased during the 40 years 1960-1990 is 59.2% (see the analysis in the report). The sentiments of some employees have also contributed to this statement. When the decisions are taken to upgrade laboratories perhaps all employees should be made aware of the rationale.
Management Practice	Ensuring that instruments, equipment and infrastructure facilities are sufficient for implementation of projects

Level of Practice	Strong
Comments/Evidence	Some research and testing laboratories are well equipped with high tech sophisticated scientific instruments. The Infrastructure facilities are sufficient except for Material Laboratory including, Paint Testing Laboratory, Paper & Packaging Testing Laboratory & Metal Testing Laboratory & Cement Testing Laboratory. The engagement of free machine time in any department for use by other departments has to be examined and the LIMS system should make it possible when developed.
Management Practice	The effectiveness of administrative procedures and support for project implementation (procurement and Distribution of equipment and materials, transport arrangements, etc.)
Level of Practice	Moderate
Comments/Evidence	The administration is falling behind due to the unavailability of information in several labs. In some laboratories use of automated high throughput instruments & techniques are necessary to enhance the speed of work.
The old instruments having frequent break downs be replaced to improve productivity and make instruments available for backup during breakdowns. **In testing laboratories, there is a need of back up instruments for high tech instruments to carry out the functions when the instruments are on major repairs. It should also be possible to get backup support from other laboratories whenever possible.** **Some of the officers held that Capital expenditure for Instruments was not distributed reasonably and suggested to evaluate the capital budgeting properly for equity and profitability.** **Some officers held that projects are extended due to lack of staff & delay in providing instruments on time.** **The Industrial Meteorology Laboratory is in need of a proper mobile van to carry working standards which has to be transported with care when going for external calibrations.**	
Management Practice	Formal monitoring and review processes are used to direct projects towards achievement of objectives
Level of Practice	Weak
Comments/Evidence	The projects are evaluated by the Research & Development evaluation committee stated in the section III. Under each project, the Research team has to submit a progress report every six months and presentations annually.

	The practice of submitting reports once in six months is unsatisfactory. There should be more frequent evaluations online preferably with a dashboard type progress monitoring of projects giving attention instantly to all danger signals.
Management Practice	The extent to which the researchers are supported by the required technical / field staff
Level of Practice	Moderate
Comments/Evidence	The technical and field staff give their fullest cooperation on testing and R&D work. Most of the testing work is done by the Research Technologists. However, there is a concern by the Research technologists that Research allowance is given only to the Research scientists. It also appears that the testing work done by the technical staff while the research scientists take the privileged position of authorizing the test results for submission. This is a division of labor that has come down from many years and is not productive in the modern laboratories. An alternative is discussed in the report.
Management Practice	Ensuring that established field / lab methods, and appropriate protocols are used
Level of Practice	Strong
Comments/Evidence	ITI is the first laboratory to get the ISO 17025 International accreditation for their testing services from SWEDAC in 2002 and at the moment 575 parameters are accredited from the Sri Lanka accreditation Board { ETL- 06, CML(Microbiology) -82, ML-30, IML-98, RAL- 237, CML (Chemical) – 122). Further R & D laboratories are ISO 9001 accredited by SLSI. Recently ITI received ISO 17034 certification as a PT provider. Therefore, the Institute apply either standard methods such as ASTM methods etc. or well established, highly reliable and validated test methods in the testing and R&D work.
Management Practice	Research projects/ S& T activities are completed within the planned time frame.
Level of Practice	Moderate
Comments/Evidence	Out of completed 27 projects, 05 projects were extended projects. Post graduate students did not complete their studies within the stipulated time. The role of postgraduate students at the ITI is important for academic purposes and should be supervised internally from ITI

	and externally by the appointed supervisors. Their contributions to the projects have to be measured by placing them in roles under a different category of postgraduate researchers. The full time research on ITI projects is the bread and butter for ITI R&D, which has to improve manyfold on performance outcomes.
Management Practice	Ensuring that scientists / researchers have access to adequate scientific information (scientific journals, internet, international databases, advanced research institutes, Universities etc.) that strengthens the quality of research
Level of Practice	Moderate
Comments/Evidence	The ITI possesses the best technical library in Sri Lanka which received ISO 9001 certification in 2016 i.e., first Library to get QMS certification. This library is open to public as well. The library has a collection of about 25,000 S&T books & Scientific Journals- on line - Science Direct. Even though a physical library with a collection of many old books is available, a modern science library needs much more than what is physically available. Access to scientific knowledge is now available instantly. Such a technology should be made practically available to the ITI employees and if outsiders are using then it should be similarly made accessible. There is a price to all these services and should be considered well in costing projects and providing external services.
Management Practice	The extent to which quality assurance practices are followed by the institutions
Level of Practice	Strong
Comments/Evidence	ITI has an extremely good quality assurance practice being an accredited laboratory for 575 parameters. ITI is the pioneer in obtaining international accreditation in 2002 from SWEDAC according to ISO 17025 and continued with expansion of accreditation parameters over the years. The total Scope extension of the accredited parameters from 2017 to 2019 was 134 (2017-10, 2018- 08, 2019-116). At present, ITI has ISO 17025 accreditation from Sri Lanka Accreditation board. Further, for the first time in Sri Lanka ITI obtained ISO 17034 accreditation as a PT provider in the fields of water microbiology, Food Microbiology and physical & Chemical parameters of cement very recently. The R&D labs are accredited as per ISO 9001. High-end accredited testing and calibration services are provided by the ITI meeting local and international standards.

Management Practice	Ensuring that researchers/ scientists have access to computers and necessary software
Level of Practice	Moderate
Comments/Evidence	The Research Scientist and Research technologists work in the laboratories that have access to computers & necessary software. The scientists and technical staff have much manual record keeping even while using some modern instruments. The available information technology in modern instruments have to be made accessible to all through training. Accessibility to scientific knowledge internationally available should be made possible to all scientists and technologists. Customers are having complaints on availability of information on progress of their services. Such information too should be made possible on digital applications. Some software on computers are outdated. Licensed software should be made available to all staff members.

Human Resource Management.

V. Human Resource Management	
Management Practice	The institution maintains and updates staff information in a database (including bio data, disciplines, experience, publications, projects)
Level of Practice	Weak
Comments/Evidence	Staff information are not maintained in a database. Hardware & software support to ITI- ERP system was introduced in 2007. There were many problems with the system. No HR part in the ERP system. However, They are planning to develop a new ERP & LIMS system. ICTA has been working on the new LIMS system. The HR, ERP and LIMS should be one system for integrated action.
Management Practice	The institution, plans and updates its staff recruitments based on programme and project needs
Level of Practice	Moderate
Comments/Evidence	From 2017 to 2019 cadre positions were not increased. Total cadre positions remain as 392 from 2017-2019. However, at the

	interviews, it was stated that 47 Special cadre positions were created for Petroleum & Pharmaceutical Lab. Cadre vacancies were filled in 2019 to a certain extent. At the moment key positions of Institute Secretary, Chief Internal Auditor, Senior Deputy Director (Administration and Human Resource), Addl. Director General (Testing Services) and Senior Legal officer are vacant.
Management Practice	The effectiveness of the selection procedures and the schemes of recruitment.
Level of Practice	Weak
Comments/Evidence	Trained staff leaving the Institute due to inadequate prospects in the respective promotional paths and good remuneration package. If training is intended to produce trained people within for various specialized work then there should be a robust containment process in place to motivate and keep them in service. The fundamental problem in HR retention is the labour division as technical and research recruited with similar qualifications and inadequate opportunities for career advancement for technical staff members. This aspect is discussed elsewhere in the report. There is no systematic collection of information on the reasons for leaving through exit interviews and therefore the reasoning and arguments are based on pure hearsay.
Management Practice	Training is based on institution and program objectives and on merit.
Level of Practice	Moderate
Comments/Evidence	There is a documented procedure of training and development. All ITI staff members are responsible in applying or requesting the training opportunities. Respective sectional SDD, ADG and Director General are responsible in selection & approving of employees for particular training. Director-HR and HRD staff are responsible in arrangement and reserving places for training. Total S&T Staff Training during the three years 2017 to 2019 have been 192 which gave 25% opportunities to S&T staff in 2019. There were 4 postgraduate level, 84 short term and 104 study tours and conferences altogether. Other staff members had overall 134 opportunities during the three years with 5 at postgraduate level, 107 short term, and 104 study tours and conferences. There were 29% opportunities given in 2019 to other staff members.

	We did not get an update for 2020 showing the weakness in HR data maintenance. ITI has several senior level vacancies and complaints about retaining trained personnel for jobs. It also does not show strengths of planning job families required for the projects. There is no data on the distribution of the training received by all technical staff members during the five years to assess their equity and need fulfillment. However, the ITI has made available the training procedure as given below.
HRD is collecting training need analysis of all ITI sections and prepare training plan at the beginning of each calendar year. **Institution and program objectives are taken into consideration in selecting people and training programs.** **Scholarship Committee Approval is needed only for foreign programs. This committee consisting of five members including DG, three ADGs and appointed another nominated person.** **Approval by the Governing Board is necessary for foreign training only.** **There is a transparent procedure to select candidates for foreign training.** **Training given to staff.** • **Postgraduate training –PhD / MPhil / MSc.** • **Graduate training for technical staff category.** • **Short term training related to different disciplines of the institute.** • **Participation in Study visits and conferences – Local / International.** • **Leadership training for management grade officers.** • **Outbound training for all staff in order to build team sprit / moral.** • **In-house training as per the succession plan of each section.**	
Management Practice	The effectiveness of the procedures in promoting a good working environment and maintaining high staff morale
Level of Practice	Moderate
Comments/Evidence	Incentive schemes for Research Scientists and other officers need revision to link with the strategic goals of the institution. Staff promotions are delayed due to internal and external factors. The organization should be growing rapidly with productivity to make employees satisfied with their remuneration. Overtime and Incentives are given to employees. It is not clear whether the incentive scheme PF380 and several other schemes applicable to HR at ITI is effective from the outcomes. ITI requires the strategy connected to HR Capital.
Management Practice	The effectiveness of staff performance appraisals
Level of Practice	Moderate

Comments/Evidence	Performance appraisals are maintained for each category of officers. The appraisal results are considered in approval of annual increments etc. It is not clear how the appraisal is connecting with annual increments. If there is merit earned during a year of work then it should be possible to take the employees up the increment ladder several steps on merit. There is no evidence on this aspect. It is also not clear if the government system allows such salary increments. Increments and Incentives are connected to human resource retention and satisfaction. This aspect needs review.
Management Practice	The effectiveness of rewards and incentive schemes in motivating the staff
Level of Practice	Moderate
Comments/Evidence	There are many Incentives for staff members. It is also challenged by some members. It is time to review the entire system with external expertise used to motivating R&D and technology sectors.
• **Performance based incentives scheme.** • **PF 380 circular based payment.** • **Research allowance based on the circular.** • **Transport allowance for Higher Management based on the government circular.** • **Telephone bill reimbursement based on government circular.** • **Appreciation awards for scientific staff who have earned scientific merits (at the Biennial Research Symposium- no financial benefit**	
Management Practice	The effectiveness of managing staff turnover, absenteeism and work Interruptions.
Level of Practice	Moderate
Comments/Evidence	Staff vacancies were filled each year and the vacancies in the year 2019 was less when compared with the 2017 &2018. Vacancies arise due to turnover and increasing positions. The digitalizing of most operations and ERP will give greater meaning to productivity and growth, which is now underway at the ITI. Then the vacancies can be reviewed with future requirements. Particularly it is necessary to compare the requirements to have a strong value chain at the ITI.

.

Management of Organizational Assets.

Vi. Management Of Organizational Assets	
Management Practice	The ability of the institution to carry out its mandate and the assigned statutory powers
Level of Practice	Moderate
Comments/Evidence	At present, the Board of management also help in improvements in this regard.
Management Practice	Infrastructure (buildings, stations, fields, roads) is satisfactorily maintained.
Level of Practice	Strong
Comments/Evidence	Only Material Laboratory was found to be not well maintained, especially Paint Testing Laboratory, Paper & Packaging Testing Laboratory, Cement Testing Laboratory & Metal Testing Laboratory. All the other laboratories, buildings and roads were well maintained. The Industrial Metrology Laboratory was well maintained with an internally-developed IT infrastructure facility to maintain smooth functioning but confined only for Metrology. Their system automatically moderates temperature and humidity 24*7 and it is a commendable achievement. Maintenance involves good housekeeping. There are several places at the ITI that can be better maintained and kept cleaned with training on 5S and such practices.
Management Practice	Vehicles and equipment (lab, field, and office) are properly managed and maintained.
Level of Practice	Moderate
Comments/Evidence	Equipment are properly managed and maintained. In Testing Laboratories all the equipment records are properly maintained. In R&D laboratories for some high tech instruments records have not been updated. The organization has a wealth of instrument assets unparalleled in Sri Lanka. The productivity, management and maintenance of these machines have to be reviewed to get the optimal ROIs. Therefore, the usage of the assets has to have a modern

	information system to make appropriate adjustments to reduce idle times and maintenance. R&D laboratories should be more consistent in maintaining records of usage.
Management Practice	The effectiveness of procedures to ensure that equipment are in working order
Level of Practice	Moderate
Comments/Evidence	Equipment maintenance was found satisfactory. The OEMs have agents outside Sri Lanka who are contracted for maintenance. If Sri Lanka has local brand agents then this situation could well be changed to reduce costs and reduce downtime.
Management Practice	The effectiveness of the institution's overall strategy in generation and proper utilization of funds
Level of Practice	Weak
Comments/Evidence	Only two areas have successfully recovered their direct recurrent expenditure. Their overheads are questionable as they have not been assigned. There are no methods of working out the ROIs of their expensive machines. Heads of each division should be able to demonstrate the returns of their capital investments in the operations to assess profitability at least at a breakeven level.
Management Practice	The extent to which the institution identifies opportunities for income generation and cost recovery
Level of Practice	Weak
Comments/Evidence	The ITI is severely lacking proactive market participation to grab opportunities. This requires a collective effort by the technical, scientific and marketing staff and a well-designed information management system. It also requires professional CRM practices and job families employed effectively..
Management Practice	The extent to which the intellectual property rights of the institute are protected
Level of Practice	Weak
Comments/Evidence	In 2012 ITI has developed an IP policy, but there were no evidence for usage of this IP policy. Need to get how many IPs have been developed from 2015 – 2020 with evidence. IPs are commercial products that should be used to generate revenue. There is no evidence of such revenue generation from IPs.

	Professional IP support with sound legal backing for a premier national research institution is essential. IP protection is a legal requirement that needs working collaboratively with the NIPO and WIPO by a qualified legal officer but there is no such officer at the ITI. ITI must be the premier IP generator in Sri Lanka and should be having the policy and legal framework thoroughly well-defined without making it a bottleneck. Foreign R&D organizations launch projects that require investment of several different IPs and thus they invest in outsourcing such IPs for a project. There was no such evidence of ITI having done any such projects.

Coordinating and Integrating the Internal Functions/ Units/Activities.

Vii. Coordinating and Integrating the Internal Functions/ Units/Activities	
Management Practice	The extent to which institution is evaluated internally and restructured based on current needs
Level of Practice	Moderate
Comments/Evidence	The management and the laboratory personnel identified the need for expanding their services by introducing following new laboratories. • Pharmaceutical lab. • Petroleum lab. • GM food lab (Biotechnology Lab). • Business centre. Many other areas are needed. One can identify these needs by examining the competencies of international laboratories and our imports and productions. The idea is to identify the potential cash cows in the economy on S&T.
Management Practice	The effectiveness of internal communication and coordination mechanisms
Level of Practice	Moderate
Comments/Evidence	Testing & R&D operation have a gap in communication that needs rectifying. Officers in the Testing laboratories are required to earn money and overloaded with testing work, have less time to do R&D work. Therefore, they have less publications etc.

	The officers in the R&D sections mainly do research work. In addition, they do testing work where methodologies to be developed. Therefore, the officers in the R&D sections have more opportunity for publications. Only a few Multidisciplinary projects. The gap in Technical and R&D staff while them having similar qualifications is causing heartburn and motivation at the ITI. This symptom seems to affect the Administrative staff as well. One of the solutions is to give Technical Officers same status as research officers through an integrated work designation.
Management Practice	Institution's overall direction and coordination are provided by a central planning committee / unit.
Level of Practice	Moderate
Comments/Evidence	Board of Management is responsible for overall direction of the Institute.
Management Practice	The extent to which different units are assigned clearly defined functions
Level of Practice	Strong
Comments/Evidence	Each laboratory has a defined set of functions to carry out. No duplication. This is a good practice. It should also take into account the multidisciplinary nature of research. Then there is a need to share the resources with other laboratories when needed.
Management Practice	Responsibilities of research / management staff are clearly identified
Level of Practice	Strong
Comments/Evidence	The responsibilities are given in their Job Description. With the advent of a new strategy a new set of functional definitions (descriptions and responsibilities) may be needed.
Management Practice	Effectiveness of using appropriate reporting procedures and feedback in management at different levels
Level of Practice	Weak
Comments/Evidence	Effectiveness of reporting procedure is about having a HR system that motivates and delivers results to bring out the best performances. It also implies the management information system that is producing financial information of the

	organization rapidly. It also implies the equipment usage and productivity information. The system that is in operation at the ITI is based on the 2nd industrial revolution factory model that is explained elsewhere in this report. The 4th industrial era that we are now in requires a more sophisticated technology oriented reporting system to inform the management whether the operations are driven to success as planned.

.

Managing Information Dissemination and Partnership.

Viii. Managing information dissemination and partnership	
Management Practice	The institution systematically plans and performs dissemination of information
Level of Practice	Moderate
Comments/Evidence	Library to be developed and new technologies to be used. Conduct seminars and awareness programs. Include new findings i.e., Research publications, Technology transfers etc. in the ITI web site. The website is not updated for accuracy of information. It should also carry in depth with broad coverage on a day to day active basis.
Management Practice	The extent to which the institution plans and maintains linkages with key partners for sharing and dissemination of information
Level of Practice	Weak
Comments/Evidence	Establishment of Business centre will be useful in this respect. The stake holders will be in a position to get updated about the required information via establishment of ERP system with LIMS and extending IT services.
Management Practice	The effectiveness of institutional procedures for technology transfer
Level of Practice	Weak
Comments/Evidence	Establishment of Business centre will be highly useful to enhance the technology transfers. Proper costing mechanism through the proposed business centre is required.

	Advertising budget should be increased. In addition, following programs will help effective technology transfer. • Give publicity over the media. • Conduct awareness events for Industries such as, Food day, Cinnamon day, Herbal products day etc. for bigger exporters, Small and medium entrepreneurs in a common platform through ITI. • Use modern technology driven means to do customized marketing.
Management Practice	The effectiveness of the system to obtain feedback from different types of stakeholders
Level of Practice	Moderate
Comments/Evidence	1st method: Feedback analysis is carried out by the Marketing & Business Development Department once a year. A feedback questionnaire was given to the customers who received services either from TEC Serv or R&D sections from ITI. The customer groups participated in the survey include government, local large scale companies, local small scale companies, multinational companies etc. Participation is 2215 customers in the evaluation conducted in 2019. The feedback collection was by post, email, verbal & telephone interviews. The questionnaire mainly focuses on the Testing services of CML, RAL, ML, IML, and ETL. The results of the feedback analysis were presented to the higher management at annual MR (Management review) meetings of ISO 9001 (R&D/ ISC) and ISO 17025 (TEC Serv). 2nd method: When the R&D sections conduct training programmes, CPs, Technology transfers (TT) the feedback forms are distributed to all the customers. The feedback results are evaluated by the officers who conducted the program. The feedback results are discussed with the Head of the section and use them to improve the future programmes. The no 1 activity is annual and it is much after the event. It is like shutting the stable door after the horse has bolted. The institute should develop their information using modern technology to take prompt and immediate action on feedback from customers. Customers need to stay connected and informed both of which failed as explained by some customers. The no 2 is again not directing the staff for prompt action and similar to no 1.

	It is needed to take corrective action by knowing what is going on and immediately by paying attention to the individual needs.

.

Monitoring, Evaluation and Reporting Procedures.

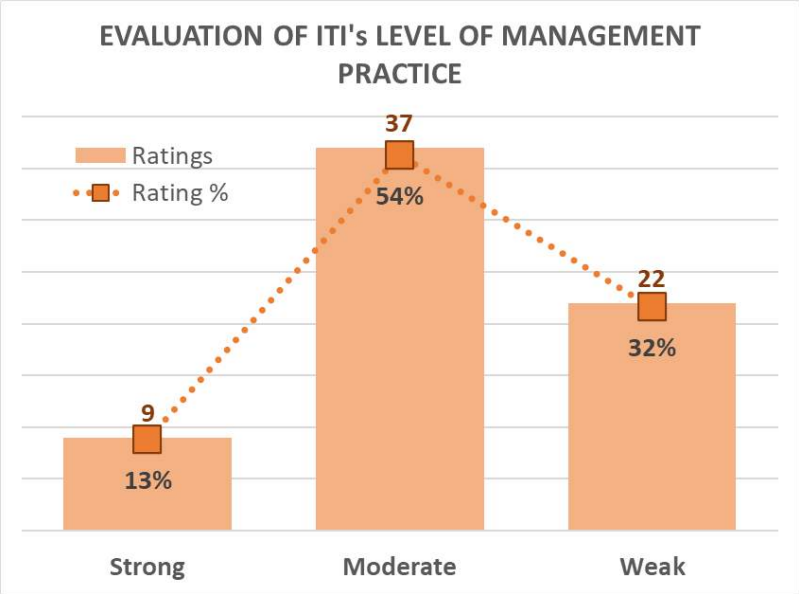
ix) Monitoring, evaluation and reporting procedures	
Management Practice	The institution monitors and evaluates (M&E) its own activities periodically
Level of Practice	Weak
Comments/Evidence	Up to date information is not readily available and therefore monitoring and taking action on corrections is mostly by letters much after the event or on the phones as it gets noticed. The higher management need a strong information system with a powerful dashboard for organization wide monitoring.
Management Practice	M&E is supported by an adequate management information system (MIS), which includes information on projects (e.g., costs, staff, progress, and Results).
Level of Practice	Weak
Comments/Evidence	No management Information system in place at the moment. See the comments immediately above.
Management Practice	The extent to which S&T results and other outputs are adequately reported internally (e.g., through reports, internal program reviews, seminars).
Level of Practice	Weak
Comments/Evidence	Conducting Seminars for internal officers on the new innovations, research findings etc. has to be carried out periodically & continuously. The officers at all levels have an attitude of minding own business having a lack of information about the activities in the organization.
Management Practice	External stakeholders contribute to the M & E process in the institution
Level of Practice	Weak

Comments/Evidence	The system in place is to satisfy the ISO certification process annually and not geared to satisfy the immediate corrective action needed for better customer management.
Management Practice	The extent to which the results of M&E are used for project/ research planning and decision making
Level of Practice	Moderate
Comments/Evidence	There is no evidence to verify how best the past track has helped in planning.

.

Assessment of the level of practice at ITI

Figure 3: Evaluation Summary of ITIs Level of Management



The outcome of the above assessment where 68 management practices have been assessed, shows a result that should draw attention of the management. The ITI has earned 13% of the management practices a "Strong" rating while the "Moderate" rating has 54%. The "Weak" practices amount to 32% which is nearly one third of the ITI's management practices. These practices have to be reviewed internally and strengthened.

Weak Areas

The Weak Areas are listed below.

1. The organizational mandate (as specified by the relevant Act) is considered in strategic planning.
2. Stakeholders needs are taken into consideration in strategic planning.
3. Stakeholder interests are considered in programme planning.
4. Stakeholders are represented in the institution's planning and review committees.
5. The extent to which organizational plans (e.g., medium-term plan, corporate plan, strategy etc.) are used to guide project selection and planning.
6. Multidisciplinary projects/ activities are encouraged by the institutions.

7. Partnership with private sector is encouraged by the institution.
8. The extent to which basic research are considered when planning projects.
9. The effectiveness of the procedures for resource allocation at different levels (organization, departments, program etc.
10. Formal monitoring and review processes are used to direct projects towards achievement of objectives.
11. The institution maintains and updates staff information in a database (including bio data, disciplines, experience, publications, projects)
12. The effectiveness of the selection procedures and the schemes of recruitment.
13. The effectiveness of the institution's overall strategy in generation and proper utilization of funds
14. The extent to which the institution identifies opportunities for income generation and cost recovery.
15. The extent to which the intellectual property rights of the institute are protected.
16. Effectiveness of using appropriate reporting procedures and feedback in management at different levels.
17. The extent to which the institution plans and maintains linkages with key partners for sharing and dissemination of information.
18. The effectiveness of institutional procedures for technology transfer
19. The institution monitors and evaluates (M&E) its own activities periodically.
20. M&E is supported by an adequate management information system (MIS), which includes information on projects (e.g., costs, staff, progress, and Results).
21. The extent to which S&T results and other outputs are adequately reported internally (e.g., through reports, internal program reviews, seminars).
22. External stakeholders contribute to the M & E process in the institution.

Moderate Areas

The Moderate areas of management practices are listed below.

1. The institution is responsive to changes in Government policies and strategies.
2. Factors such as strengths, weaknesses, threats and opportunities are considered in strategic planning.
3. The Board of Governors is involved in strategic planning.
4. The extent to which staff members are involved in strategic planning.
5. Government allocations and alternative funding opportunities (donor funding) are considered in strategic planning.
6. The extent to which policies and plans of the organization are reviewed and updated.
7. Board of Governors participate in planning and priority setting of program.
8. The extent to which the staff of the institution participate in programme planning and priority setting.
9. The extent to which the availability of funds (government allocations and other funds) generating funds are taken into consideration in planning programmes.
10. The obtaining of necessary equipment is considered in planning programmes.
11. The extent to which socio economic and commercialization of aspects are considered in programme planning.

12. Effectiveness and efficiency of institutional procedures in approving new S&T programmes
13. The staff is provided with guidance for project planning.
14. Previous research results/data are used for planning projects.
15. Foreign collaborations are encouraged and incorporated in planning.
16. The extent to which development research/activities are considered in planning projects.
17. The degree to which adverse effects on environment are considered in planning projects.
18. The effectiveness of administrative procedures and support for project implementation (procurement and Distribution of equipment and materials, transport arrangements, etc.)
19. The extent to which the researchers are supported by the required technical / field staff.
20. Research projects/ S& T activities are completed within the planned time frame.
21. Ensuring that scientists / researchers have access to adequate scientific information (scientific journals, internet, international databases, advanced research institutes, Universities etc.) that strengthens the quality of research.
22. Ensuring that researchers/ scientists have access to computers and necessary software.
23. The institution, plans and updates its staff recruitments based on programme and project needs.
24. Training is based on institution and program objectives and on merit.
25. The effectiveness of the procedures in promoting a good working environment and maintaining high staff morale.
26. The effectiveness of staff performance appraisals
27. The effectiveness of rewards and incentive schemes in motivating the staff.
28. The effectiveness of managing staff turnover, absenteeism and work Interruptions.
29. The ability of the institution to carry out its mandate and the assigned statutory powers.
30. Vehicles and equipment (lab, field, and office) are properly managed and maintained.
31. The effectiveness of procedures to ensure that equipment are in working order.
32. The extent to which institution is evaluated internally and restructured based on current needs.
33. The effectiveness of internal communication and coordination mechanisms
34. Institution’s overall direction and coordination are provided by a central planning committee / unit.
35. The institution systematically plans and performs dissemination of information.
36. The effectiveness of the system to obtain feedback from different types of stakeholders.
37. The extent to which the results of M&E are used for project/ research planning and decision making.

Strong Areas

The Strong areas of management practices are listed below.

1. National development goals are considered in planning programs & setting priorities.
2. The extent to which programmes are planned and approved through appropriate procedures.
3. The extent to which the institution follows a formal process for preparation, review and approval of projects.
4. Ensuring that instruments, equipment and infrastructure facilities are sufficient for implementation of projects.
5. Ensuring that established field / lab methods, and appropriate protocols are used.
6. The extent to which quality assurance practices are followed by the institutions.
7. Infrastructure (buildings, stations, fields, roads) is satisfactorily maintained.
8. The extent to which different units are assigned clearly defined functions.
9. Responsibilities of research / management staff are clearly identified.

Output Assessment (Productivity of the Institution).

Technologies Developed/ Available Technology Transfers at Present.

The following information is produced from the original data given to the review team through the SER and other sources at ITI. However, the ITI claims these are only technologies developed using R&D. As per the corporate plan 2020 -2024 the revenue from technology transfer in 2017, 2018, and 2019 are 2.77mil, 3.20mil and 7.51 mil.

Table 2: Technologies developed/ Available Technology Transfers at present

Output	1. New Technologies/products Developed
No	

Start Year	End Year	Sum of Technologies / Methodologies
2013	2018	5
2014	2017	4
2015	2017	6
	2018	5
	2019	13
2016	2017	4
	2018	9
	2019	12
	2020	1
2017	2018	1
	2020	4
2018	2019	9
	2020	15
	2021	8
Total		96

The annual average is about 16.

General comments on Quality and relevance of outputs and productivity of Institute.	As the information given by ITI, even though 96 technologies / products were developed only 6 % of them have contributed.

Technologies developed/ Available Technology Transfers at present

Output	2. New Technology Transfers available at present
No	

Start Year	End	Sum of Technology Transfers
2013	2018	
2014	2017	
2015	2017	
	2018	2
	2019	
2016	2017	
	2018	
	2019	1
	2020	
2017	2018	
	2020	
2018	2019	1
	2020	
	2021	2
Total		6

The outcomes work out to an average of one technology transfer per year while having 16 developed.

General comments on Quality and relevance of outputs and productivity of Institute.	ITI use exclusive and nonexclusive technology transfer. They used different approaches for technology transfer. First, advertise in the media for 'Expression of Interest'. If the technology is transferred to a group (maximum of 20 person per group etc) then use non-exclusive technology transfer. If a person / company needs the ownership then use exclusive technology transfer. Exclusive Technology transfer is usually valued over Rs. 1 million per technology. Mainly technology transfer is done by food technology, herbal technology and material technology sections. The biotechnology and environmental technology sections are mainly involved in analysis related work and not for technology developments. Electrical technology and engineering technology (such as machinery developments) sections are also sometimes involved in technology transfer.

The following information was extracted from the Corporate Plan 2020-2025

Technology transfers from 2017 – 2019 (Major Technology Transfers).

1) Bio wax to extent the storage / shelf life of Mango and Papaya.
2) Tree fresh formulation to retain fruits in the tree delaying the harvesting period.
3) Fruit wrapping paper from waste banana fibre.
4) Instant Thosai and Idli mixture.

5) RTS beverages from fruits.
6) Osmotically dehydrated jak fruit and mango.
7) Bottled garlic and curry leaves paste.
8) Nutritious scone (Flat bread).
9) Liquid detergents.
10) Hand sanitizer liquid.
11) Herbal cosmetic products.
12) Natural insecticidal spray.

Technologies Transferred in 2020 (January to June).

Food Technology Section-05.

1) Technology transfer on coconut vinegar technology (Traditional method).
2) Technology transfer on convenient complementary flour mixture.
3) Technology transfer on manufacture of pol sambol.
4) Technology transfer on candied peel.
5) Technology development and technology transfer on frozen potato French fries.

Herbal Technology Section-02.

1) Technology transfer of Herbal Balm – Parakrama Products (CTS 2005816).
2) Agreement was signed for Kithul Palm Wine (Agri Deshiya (Pvt) Ltd.).

Material Technology Section-06.

1) TT on preparation of incense sticks – TT 2001614.
2) TT on liquid car wash, liquid tile cleaner, liquid dish wash, liquid toilet bowl cleaner, liquid glass cleaner, Liquid hand wash and liquid Air freshener. TT 2005067.
3) TT on liquid car wash, liquid tile cleaner, liquid dish wash, liquid toilet bowl cleaner, liquid glass cleaner, Liquid hand wash and liquid Air freshener. TT 2005069.
4) TT on liquid car wash, liquid tile cleaner, liquid dish wash, liquid toilet bowl cleaner, liquid glass cleaner, Liquid hand wash and liquid Air freshener. TT 2005537.
5) TT on liquid car wash, liquid tile cleaner, liquid dish wash, liquid toilet bowl cleaner, liquid glass cleaner, Liquid hand wash and liquid Air freshener. TT 2005538.
6) TT on liquid car wash, liquid tile cleaner, liquid dish wash, liquid toilet bowl cleaner, liquid glass cleaner, Liquid hand wash and liquid Air freshener. TT 2005536.

Technologies Transferred in 2019.

Food Technology Section-13.

1) Technology Transfer on Frozen Tapioca.
2) Technology transfer on tamarind drink.
3) Technology transfer on canned ‘Kirikos’ curry.
4) Technology transfer on Nutritious Scone.
5) Technology transfer on cocktail mix.
6) Technology transfer on cassava chips.
7) Technology transfer on ready to serve ginger drink.

8) Technology transfer of natural vinegar.
9) Technology transfer on RTS fruit drink.
10) Technology transfer on RTS ginger drink.
11) Technology transfer on red coconut sambol.
12) Technology transfer on osmotically dehydrated jak fruit and mango.
13) Technology Transfer on bottled garlic and curry leave paste - Harischandra Mills PLC.

Herbal Technology Section-03.

1) Herbal Toothpaste.
2) TT 1901562 – Toothpaste (Dr. D. I. I. Wijesinghe).
3) Technology for fairness herbal face wash, day cream, fairness night cream, shampoo and body lotion (ACE Healthcare (Pvt) Ltd.).

Material Technology Section-06.

1) Toilet bowl cleaner and liquid hand wash.
2) Preparation of solid soap.
3) Preparation of liquid detergent series (Car wash, Tile cleaner, Dish wash, Toilet bowl cleaner, Glass cleaner, Hand wash and Air freshener).
4) Technology development and transfer on hand sanitizer liquid.
5) Technology development and transfer on food grade detergent.
6) TT on liquid car wash, liquid tile cleaner, liquid dish wash, liquid toilet bowl cleaner, Liquid glass cleaner, Liquid hand wash and liquid Air freshener. TT 1917373.

Technologies developed/ Available Technology Transfers at present

Output	3. Technology/ product Improvements
No	Not available

General comments on Quality and relevance of outputs and productivity of Institute.

Start Year	End Year	Method Validations	Methods transferred Inside	Major Outputs	Technologies / Methodologies
2013	2018				5
2014	2017				4
2015	2017				6
	2018				5
	2019				13
2016	2017				4
	2018	4			9
	2019				12
	2020	6	2	2	1
2017	2018				1
	2020				4
2018	2019			2	9

		2020				15
		2021				8
	Total		10	2	4	96

Some of the other information shows Major Outputs, Method Validations and Methods Transferred Inside. There may be some product improvements hidden here as well as in the new technology.

.

Technologies Transferred to Industry / Entrepreneurs.

Technologies transferred to industry / entrepreneurs	
Output	Technologies Developed locally and transferred to the Industry/ entrepreneurs
No	6
Output	Foreign Technologies adopted and transferred
No	2
General comments on Quality and relevance of outputs and productivity of Institute.	See below

General comments on Quality and relevance of outputs and productivity of Institute.

Further, ITI has not sold a technology to a foreign country but one technology transfer to Vietnam on isolation of gelatin from fish cartilage was done through a NORAD project, no funds received for this technology transfer. Similarly, technology obtained through IDRC protect was shared with the collaborators. Given below are the three major outputs as per their SER. Total income of the TT from 2016 to 2020 was Rs. 24.105 million.

Most significant projects outputs during this period were.

1. Technologies of bio waxes and tree fresh formulation have been transferred to Hayleys Agriculture Pvt. Ltd. Products are available on sale.

2. Banana paper processing technology has been transferred (as CSR program) to two entrepreneurs in Embilipitiya and Jaffna.

3. Bottled iced coffee technology have been transferred to the Soul Coffee Company Pvt Ltd.

4. Introduction of technologies to Industry: Microwave Hydro-diffusion and Gravity technology was introduced to industries including the Spice Council of Sri Lanka, Laughs Holdings Limited, David Pieris Group of Companies and Island wide Marketing Services (Pvt) Ltd.

5. Awareness program has been conducted for small –medium scale restaurant operators on “Risks of incorrect milk beverage processing”.

6. Technology Awareness program has been carried out for.

- Samples of bamboo activated carbon and bamboo vinegar have been transferred to Janet Lanka Pvt Ltd.
- Deliver bamboo curing unit with controlling of mold growth to Kelani Kala Handicraft Centre Yatiyanthota.

Foreign technology transfer has been adapted when a person was sent to a foreign country for training. Then ITI is expected that the person trained should introduce that technology to improve or implement in Sri Lanka. But ITI do not maintain a list of technologies adapted from foreign countries. However, some of them are.

- "Solar power dryer" developed by Germany.
- Food ripening using etheral from India.
- Cinnamon ……through Indu-Sri Lanka project.
- Method development for different testing.

Information Dissemination / Extension

Output Management Practice Management Practice	**No**
Publications. **S&T institutional Review Reports.** **Training Manuals.** **Advisory Leaf lets.** **Posters** **Dissemination Events.** **Workshops and Seminars.** **Conferences.** **Exhibitions.** **Media events.** **Open days.** **Demonstrations**	414 as per SER. No breakdown of the publications. 96 research publications according to as Measurable Outcomes of Projects. 119 No of research published in refereed journals as per annual reports 2017-2019 3 Services to Overseas Industries, 897 Services to Local Industries as per annual reports 2017-2019

Start Year	End	Book Chapters	Popularization activities/ workshops	ITI Booklet
2013	2018			
2014	2017			
2015	2017			
	2018	2	5	

	2019	1	2	
2016	2017			
	2018	1		
	2019			
	2020			
2017	2018			
	2020			
2018	2019		2	
	2020			1
	2021			
Total		4	9	1

General comments on Quality and relevance of outputs and productivity of Institute.

ITI is not involved in conducting extension programs. However, they do support training program upon customer request. Only extension program that has been conducted by ITI was 'Vidatha'. ITI contributed to transfer technology similar to extension program, when 'Vidatha' needed any technology to be obtained from ITI. All the programs conducted by ITI are advertised on the website. However, ITI has conducted several workshops, seminars, newspaper articles, television programs and magazine articles and some of them are given below.

- IDRC project on postharvest loss reduction of mango papaya and banana has been disseminated through workshops conducted among farmers, exporters/ supermarkets and industrialists, government officials / agriculture officers/ extension officers/ health, schoolteachers, and University students / school children.
- A mobile app Dialog 'Govi Mithuru- Farmers' Friend' has been developed on information dissemination on Pre and Postharvest management of Mango, Papaya and Banana.
- Under the project on "Rapid extraction of medicinal & aromatic plants and flowers & selective isolation of compounds by microwaves".
    a. Demonstrations for undergraduate research students and trainees.
    b. Product display at technology exhibitions.
- Paper article published in "Vidusara" on 21st February 2018 (page 5 and 25) about the new inventions from Sri Lankan scientists for the development of local dairy bio processing industry (http://www.vidusara.com/2018/02/21/viduindex.htm).
- Television Program in Sri Lanka Rupavahini on postgraduate research ""Biodiversity and Technological Potential of Micro-flora from Selected Sri Lankan Dairies", The Tuesday Knowledge, 4.30-5.00 pm, 1st 09th July 2019 (https://www.youtube.com/watch?v=Xm4XSF8-DXA&feature=share).
- Newspaper articles on the project Enhanced preservation of fruits using nanotechnology and project outcomes were published.
- Magazine article on the project on Enhanced preservation of fruits using nanotechnology was published in BusinessLK.

- Link to project on Enhanced preservation of fruits using nanotechnology -summary in the Youtube, uploaded in 2018, https://www.youtube.com/watch?v=slYzHTTydRk.
- Paper article published in "Vidusara" on 21st February 2018 (page 5 and 25) about the new inventions from Sri Lankan scientists for the development of local dairy bio processing industry (http://www.vidusara.com/2018/02/21/viduindex.htm).
- Television Program in Sri Lanka Rupavahini on postgraduate research ""Biodiversity and Technological Potential of Micro-flora from Selected Sri Lankan Dairies", The Tuesday Knowledge, 4.30-5.00 pm, 1st 09th July 2019 (https://www.youtube.com/watch?v=Xm4XSF8-DXA&feature=share).

Research Publications

Output	No
Research Papers in Peer Reviewed ISI Journals.	33
Other Research Papers.	
Conference proceedings.	151
Books and Monographs.	10
Book chapters.	03
Technical Reports.	
Research Reports	

A detail analysis of publications is given in the report elsewhere.

General comments on Quality and relevance of outputs and productivity of Institute.

Several awards and recognition have been given for the publications and presentations made in reputed journals and conferences.

Patents

Output		No
Individual		
I.	**Local**	
II.	**Foreign**	10
Institutional		
I.	**Local**	
II.	**Foreign**	

.

General comments on Quality and relevance of outputs and productivity of Institute. (Contd.)

Ten Sri Lankan patents have been obtained by ITI; details are given below.

1. Ceylon cinnamon (Cinnamomum zeylanicum) capsule for reducing cholesterol and blood pressure.

2. Processing technology of papers/boards from banana fiber for sorption and slow-release applications (SL Patent No: 17575)**.**
3. Processing technology of banana fiber-polymer composite board for slow releasing applications of trapped active compounds (SL Patent No: 18029)**.**
4. Bio wax formulation, SL Patent No. 18030**.**
5. Method of clay modification and optimized mineral composition for removal of hardness and other contaminants from water. Sri Lanka Patent application No. 20669 (2019).
6. Serial Pot Filter System for Removal of Hardness, fluoride, and Heavy Metal Ions from Water. Sri Lanka Patent application No. 20234 (2018).
7. Heat conducting wear resistant rubber/graphite composite and preparation method thereof – Patent Application No. 20614.
8. Formulation of instant nutritious horse gram-based porridge mix.
9. Formulation ready to serve instant dry powdered horse gram based nutritious drink.
10. Formulation of ready to serve horse gram based nutritious granola bar.

Services (Testing, Calibrations, Consultations, Advisory and etc.)

Output	**No**
Monitoring of Research Projects (completed projects 2015 – 2020)	27
Consultancy Services	SER states 1844, Annual Reports 2017-2019, 1280
Environmental Impact assessments **Testing and analytical services** **Instrument Calibrations**	2017- 2019, 54578 as per SER 57510 as per Annual Report, 2017-2019
Research Grants awarded & Administered	As per SER, Completed 27, Ongoing 18 (as per Annual Report 2017-2019, 34)
Data bases Developed	We noticed one database for IML internal use

General comments on Quality and relevance of outputs and productivity of Institute (Contd.)

Trainings

Output **Staff Training Programs**	**No**
I. Local **II. Foreign**	126 study tours and conferences as per SER. 191 short term trainings as per SER. 32 as per Annual Report.
Other Training Programs **I. Training Workshops** **II. University Undergraduates**	668 Training Workshops as per Annual Report 2017-2019 More than 100 university trainings in 2015 as per Annual Report

Analysis of outputs from the Self Evaluation Report

There have been 96 Technologies/Methodologies developed at ITI from 2013 to 2018 but only 6 transferred. There have been 10 Method Validations, 2 Methods Transferred Inside and 4 Major Outputs.

Table 3: Technologies Developed, Transferred, etc.

Start Year	End Year	Sum of Technologies / Methodologies	Sum of Technology Transfers	Sum of Method Validations	Sum of Methods transferred Inside	Sum of Major Outputs
2013	2018	5				
2014	2017	4				
2015	2017	6				
	2018	5	2			
	2019	13				
2016	2017	4				
	2018	9		4		
	2019	12	1			
	2020	1		6	2	2
2017	2018	1				
	2020	4				
2018	2019	9	1			2
	2020	15				
	2021	8	2			
Total		96	6	10	2	4

The ITI had 33 Journal Papers, 151 Abstracts (Communications), 7 Articles, 4 Book Chapters, and 23 Awards from 2013 to 2018.

The ITI has had award winning 2 research projects started in 2015 and 3 in 2016 and outcomes awarded 6 in 2017, 8 in 2018, and 9 in 2019.

Table 4: Publications from SER 2013 to 2018

Start Year	End Year	Journal papers	Abstracts (Communications)	Articles	NCBI GEN Bank submissions	Awards/ Recognition
2013	2018		2			
2014	2017		6			
2015	2017	5	3	2	20	6
	2018	9	12	3	15	5
	2019		28		13	
2016	2017		5		3	
	2018	5	23			3

	2019	4	33	2	16	9
	2020	4	9			
2017	2018		2			
	2020	3	9		46	
2018	2019		3			
	2020	2	6			
	2021	1	10			
Total		33	151	7	113	23

There were 4 Postgraduates completed during the period from 2013 to 2018 and 9 ongoing as of 2018.

Table 5: Postgraduates from ITI 2013-2018

Start Year	End Year	Sum of Postgraduates Completed	Sum of Postgraduates Ongoing
2013	2018	1	
2014	2017		
2015	2017		1
	2018	1	1
	2019		1
2016	2017		
	2018	2	1
	2019		
	2020		1
2017	2018		
	2020		
2018	2019		
	2020		
	2021		4
Total		4	9

There were 10 patents granted during the years from 2013 to 2018 while another 3 were pending.

Table 6: Patents Granted for ITI 2013-2018

Start Year	End Year	Patents Granted	Patents Pending
2013	2018		

There were 9 instances of popularization activities and one booklet published by the ITI during 2013 to 2018 period.

Table 7: Popularization Activities at ITI 2013-2018

Start Year	End Year	Popularization activities/ workshops

2014	2017		
2015	2017	1	
	2018	3	1
	2019		
2016	2017		
	2018		1
	2019	2	
	2020		1
2017	2018		
	2020		
2018	2019		
	2020	3	
	2021	1	
Tot		10	3

2013	2018	
2014	2017	
2015	2017	
	2018	5
	2019	2
2016	2017	
	2018	
	2019	
	2020	
2017	2018	
	2020	
2018	2019	2
	2020	
	2021	
Total		9

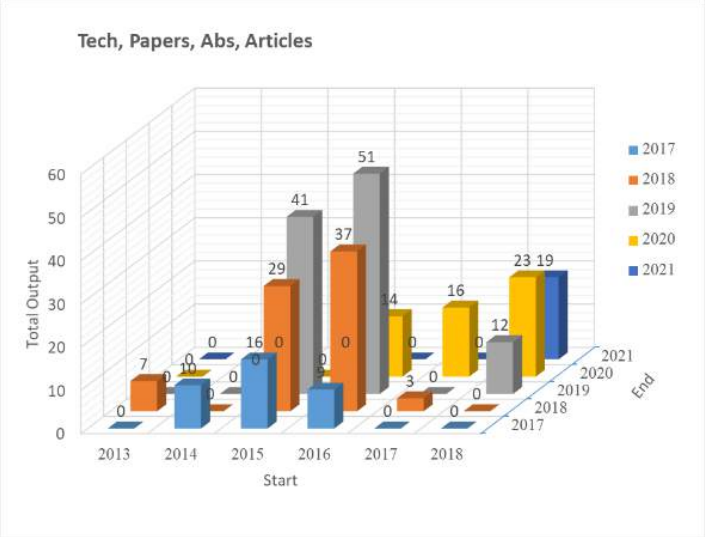
The following table shows the number of Abstracts, Papers, Articles, and Technologies completed having started in a particular year from 2013 to 2018 and Finishing in the year indicated. As you can see there are finishes in the same year as started.

Table 8: Number of Abstracts, Papers, Articles, Technologies Start and Finish

Number of Tech, Papers, Abs, Articles Completed (Start to Finish)

Tech, Papers, Abs, Articles	Finish					
Start	2017	2018	2019	2020	2021	Total
2013	0	7	0	0	0	7
2014	10	0	0	0	0	10
2015	16	29	41	0	0	86
2016	9	37	51	14	0	111
2017	0	3	0	16	0	19
2018	0	0	12	23	19	54
Total	35	76	104	53	19	287

Figure 4: Number of Abstracts, Papers, Articles, Technologies Start and Finish



The figure is complementary to visualize the situation in the context of the numbers shown above.

The following table shows the average number of months taken by the projects of the above table. Those started in 2013 and completed in 2018 have taken 60 months and the highest but the rest have been improving and down to average 26 in 2018.

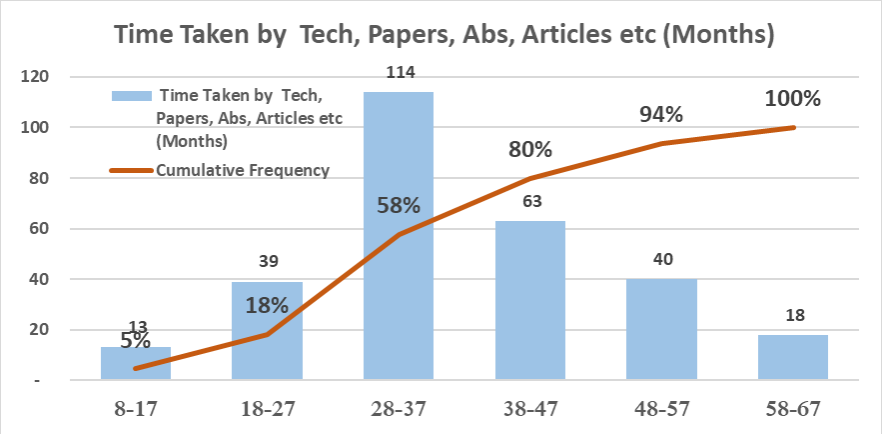
Table 9: Average of Months Taken from Start to Finish of the ITI Projects

Average of Months Taken from Start to Finish

	Finish					
Start	2017	2018	2019	2020	2021	Average
2013		60				60
2014	37					37
2015	21	39	53			42
2016	18	28	38	48		35
2017		17		32		29
2018			15	24	37	26
Average	24	33	33	31	37	32

The frequency distribution of the months taken to complete is shown in the chart below.

Figure 5: Frequency Distribution of the Months Taken to Complete Tech, and Articles, etc.



The tables below show the duration taken by Technology, Publications, etc, There is no attempt to describe the tables as they are self-explanatory. Since there are no benchmarks, we cannot make comparisons but using experiences elsewhere we feel the time durations are sometimes excessive.

Table 10: Compendium (1) of Tables Showing the Durations Taken to Complete ITI Work

Months Taken	Technology/ Methods	Percent
8-17	8	8%
18-27	20	21%
28-37	42	44%
38-47	7	7%
48-57	10	10%
58-67	9	9%
Total	96	100%

Months Taken - Tech, Papers, Abs, Articles	Percent
8-17	5%
18-27	14%
28-37	40%
38-47	22%
48-57	14%
58-67	6%
Total	100%

Months Taken	Abstracts (Comm	Percent
8-17	5	3%
18-27	12	8%
28-37	59	39%
38-47	40	26%
48-57	26	17%
58-67	9	6%
Total	151	100%

Months Taken	Articles	Percent
8-17		0%
18-27	2	29%
28-37		0%
38-47	5	71%
48-57		0%
58-67		0%
Total	7	100%

Months Taken	NCBI GEN Bank submissions	Percent
8-17		0%
18-27	23	20%
28-37	46	41%
38-47	31	27%
48-57	13	12%
58-67		0%
Total	113	100%

Months Taken	Awards/ Recognition	Percent
8-17		0%
18-27	6	26%
28-37	3	13%
38-47	14	61%
48-57		0%
58-67		0%
Total	23	100%

Months Taken	Patents Granted	Patents Pending
8-17		
18-27	1	
28-37	6	1
38-47	3	1
48-57		1
58-67		
Total	10	3

Months Taken	Technology Transfers
8-17	
18-27	1
28-37	3
38-47	2
48-57	
58-67	
Total	6

Table 11: Compendium (2) of Tables Showing the Durations Taken to Complete ITI Work

Months Taken	Book Chapters
8-17	
18-27	
28-37	1
38-47	2
48-57	1
58-67	
Total	4

Months Taken	Popularization activities/ workshops
8-17	
18-27	2
28-37	
38-47	5
48-57	2
58-67	
Total	9

Months Taken	Major Outputs
8-17	2
18-27	
28-37	
38-47	
48-57	2
58-67	
Total	4

Months Taken	Method Validations
8-17	
18-27	4
28-37	
38-47	6
48-57	
58-67	
Total	10

Months Taken	Methods transferred Inside
8-17	
18-27	
28-37	
38-47	2
48-57	
58-67	
Total	2

Months Taken	ITI Booklet
8-17	
18-27	
28-37	1
38-47	
48-57	
58-67	
Total	1

Ongoing Postgraduates	Months Taken
2	28-37
1M.Phil	38-47
1Ph.D	18-27
	28-37
	38-47
	58-67
2M.Phil	28-37
Total	

Completed Postgraduates	Months Taken
1	28-37
1M.Sc	18-27
1Ph.D	38-47
	58-67
Total	

Accreditation of Testing Laboratories.

ITI takes pride in accreditations it has received for testing laboratories. We have analyzed the data made available for accreditations during the review period. The following picture has emerged.

Testing Methods and Laboratories SLAB

The ITI has received accreditations from SLAB on 575 Parameters for 293 Matrices, 267 Standards, and accredited for the following labels.

Table 12: SLAB Accredited Testing Methods and Laboratories

Testing Method	Laboratory	Percent
ISO/ IEC 17025: TL 004 – 05	Residual Analysis Laboratory	41%
ISO/ IEC 17025: TL 004 – 01	Chemical & Microbiology Laboratory	21%
ISO/ IEC 17025: CL 005 – 01	Industrial Metrology Laboratory	17%
ISO/ IEC 17025: TL 004 – 02	Chemical and Microbiology Laboratory	14%
ISO/ IEC 17025: TL 004 – 03	Materials Laboratory	5%
ISO/ IEC 17025: TL 004 – 04	Electro Technology Laboratory,	1%

The SLAB has accredited ITI with this authority. These accreditations are spread over a period of two years 2019 -14.3%, and 2020 - 85.7%. The renewals are due for these accreditations on 2022-11-10 - 14%, 2023-05-13 - 63%, and 2023-06-29 - 22%.

ITI has received SWEDAC accreditations as follows – SWEDAC accreditation validity period was 2004-2015 and SWEDAC had requested ITI to maintain the SLAB accreditation as ITI has an international accreditation BOD in Sri Lanka.

Scopes SLAB

The accredited scopes are as follows:

Performing residue analysis and trace metal analysis in product categories of Water, Wastewater, Food & agricultural products, Fertilizer and Cosmetics as per the test methods appearing in the Schedule: 41% for Residual Analysis Laboratory.

Performing Chemical Testing on Products Categories of Food & Agricultural Products, Fertilizer, Cosmetics, Wastewater & Water and Sampling of Wastewater & Water as per the Test Methods appearing in this Schedule: 21% for Chemical & Microbiology Laboratory.

Performing Mechanical (Dimension & Mass), Electrical, Thermal and Volumetric calibration as per the test methods appearing in the schedule: 17% for Industrial Metrology Laboratory.

Performing Microbiological Testing on Products Categories of Food & Agricultural Products (Fish/Shrimp, Sea Food, Spices, Green & Black Tea, Herbal Products, Coconut products, Meat products, Milk products, Ice Cream, Wheat based products, Carbonated & non-carbonated beverages, ready to serve drink), Water/Ice, Bottled drinking water, Surface & River water,

Swimming pool water, sampling of water, Cosmetics and Toothpaste as per the Test Methods appearing in this Schedule: 14% for Chemical and Microbiology Laboratory.

Performing Chemical Testing on Cement and Metal (Reinforcement Steel) and Mechanical Testing on Metal (Reinforcement Steel) as per the test methods appearing in this schedule: 5% for Materials Laboratory.

Performing Mechanical Testing (Sound and Vibration Measurement): 1% for Electro Technology Laboratory.

Frequent Standards of Testing SLAB

Most frequent standards out of the 267 that occur 5 or more times are listed below.

Table 13: Frequent SLAB Accredited Testing Methods

Method	Frequency
RAL/MM/01/04/001	57
RAL/MM/02/01/004	28
RAL/MM/01/05/001	27
RAL/MM/01/01/001	27
RAL/MM/01/01/003	23
MM/VO/01 Rev05	21
RAL/MM/01/01/002	18
RAL/MM/02/01/005	14
MM/VO/02 Rev	11
RAL/MM/02/03/001	9
RAL/MM/02/04/001	8
RAL/MM/01/07/002	8
MM/VO/01 Rev 05 Glassware Gravimetric Method	7
SLS 82422018	6
SLS 3752009 and BS 44492005 + A32016	6
MM/EL/01 Rev 07	5
RAL/MM/02/02/002	5
SLS 516/3 sec 12013 ISO 4831 2006	5

Standard Test Methods used in Accreditation.

There are many other standard test methods but not accredited used in the laboratories of which some examples are given below.

Table 14: Standard ITI Testing Methods

	Test method	Frequency
1	ISO 37:2017	2
2	ISO 21528-2:2017	2
3	APHA 1060 (23rd edition)	1
4	APHA 2310 B (23rd edition)	1
5	APHA 5530 B (23rd edition)	1
6	ISO 10727	1
7	SLS 516/12: 2013 ISO 7251: 2005	1
8	ISO 15598 - 1999 (E)	1
9	ISO 1573 - 1980 (E)	1
10	APHA 4500 N03 B (23rd edition)	1

Frequent Purposes of Testing SLAB

The purposes occurring more than 5 times out of the 293 are listed below.

Table 15: Purposes of Testing

Purpose	Frequency
Determination of conventional Mass value of weights/ Direct comparison Laboratory CMC	23
Piston operated volumetric Apparatus	11
Volumetric flask	9
E.coli (MPN)/g	8
Comparison Laboratory/ Onsite	8
Comparison Laboratory	8
Salmonella /25g	8
Graduated measuring cylinder	8
Mercury Hg	7
Lead Pb	7
One mark pipette / Graduated pipette	7
Arsenic As	7
Cadmium Cd	7
Coliforms (MPN)/g	6
Aerobic Plate Count /g	6
Staphylococcus aureus/g	6
Dimethoate	5
Peroxide value	5
Comparison with reference weight Onsite / Laboratory	5
Diazinon	5
pH at 27 oc	5

Accreditations by SWEDAC

ITI received 19 accreditations for three years: 2019 – 12, 2018 – 2, and 2017 – 5.

The laboratories that received such accreditations were RAL, CML, and IML as follows:

RAL – 8, CML – Food and Agro Lab – 7, CML – Water & Wastewater Lab – 3, and IML – 1.

The products that received such accreditations are as follows.

Table 16: Products Accredited by SWEDAC

Carbonated beverages RTS Cordial Gherkins Fruit juice Jam 2	**3**
Water and Wastewater	3
Cereal Based food items	2
Tea	2
Milk Powder, Cereal Based Food items, Coconut Oil, tea brew	1
Fruit juices, quashes, Cordials, Fruit drinks	1
Skin Cream & Lotion	1
Spices	1
Foods of animal Origin	1
Cereal & Cereal based products	1
Balance Calibration - Up to 200kg Micro Balance - Resolution of 1mg Micro Pipettes 1 µl to 10 µl Digital Vernier calipers/Dial Gauge/Micrometers Glass rulers 2	1
Toothpaste	1
Water	1

The testing is carried out to detect the following.

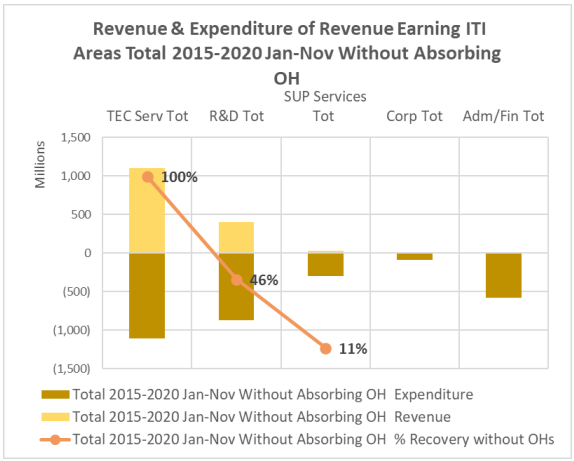
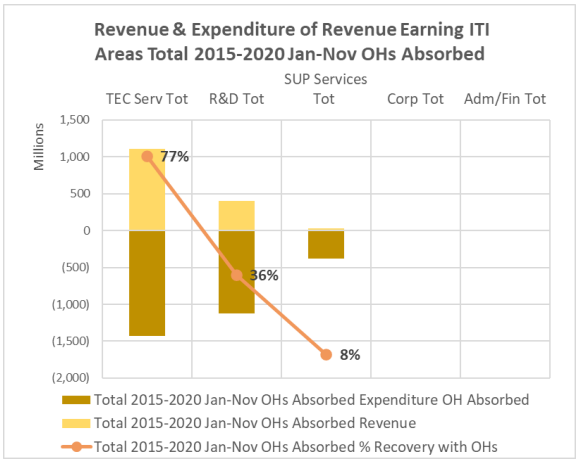
Table 17: Elements/Compound for Detection from SWEDAC Approved Methods

Benzoic Acid Sorbic Acid 2	**3**
Arsenic Cadmium Lead Mercury	2
Moisture Ash Fat Protein Carbohydrate Fiber Sugar Sodium2	2
Sulfate Calcium Total Nitrogen	1
Nutritional label	1
Balance Calibration	1
Caffeine	1
Sulfadimethoxine Sulfamerazine Sulfathiazole Sulfachloropvridazene Sulfadiazine Sulfamethoxypridazine Sulfamothaxazole Sulfamthazine	1
Hexaconazole Tebucormzole Diazinon Carbofuran Fipronil Imidacloprid Quinalfos Dimethoate Tricyclazole Fenamiphos Flutolanil Triazophos Chlopyrifos Profenophos Fenoxaprop-p-ethyl Pirimiphos methyl Fenthion Norvaluron Diuron Pyraclostrobin Flutriafol Thiacloprid Indoxacarb Captan Isoprothiolane Fenithrothion Phenthoate Tebufenozide Azoxystrobin Bitertanol MCPA	1
α HCH b HCH g HCH d HCH Heptachlor Aldrine Heptachloroepoxide Endosulfan I Endosulfan II Dieldrin Endrin P,P' DDE 0,P, DDD P,P' DDT Trifluralin Endrin Aldehyde Endosulfan Sulphate HCB	1
Antimony Cadmium Lead Mercury	1
Arsenic Cadmium Lead Tin Mercury	1
Anionic Surfactants	1
Kjeldahl Nitrogen Sulfide Total Phenol Hexavalent Chromium Oil and Grease	1
Metribuzin Hexaconazole Tebuconazole Diazinon Thimethoxam Carbofuran Fipronil Imidacloprid Quinalfos Dimethoate Methomyl Tricyclazole Fenamiphos Flutolanil Triazophos	1

Chlopyrifos Profenophos Fenoxaprop-p-ethyl Pirimiphos methyl Fenthion Norvaluron Diuron Pyraclostrobin Flutriafol Thiacloprid Indoxacarb Captan Isoprothiolane Fenithrothion Phenthoate Tebufenozide Azoxystrobin Bitertanol MCPA	

Revenue and Expenditure.

As a fee levying customer service organization well equipped to serve the customers with a large cohort of qualified and experienced professionals, ITI is in a premier position to run a profitable sustainable operation year round. The review obtained data for the five years under review with 2020 up to November and examined the profitability of the operations. It is clear that the operations are loss making in several divisions and sections making the total organization run at a large deficit, which has to be covered with government grants. The ITI senior management attributes their losses to having to attend many services without charging or assigning any value. This is a mindset in most government organization that finds the excuses for their inability to breakeven. The ITI has the freedom to charge and therefore it must strategize to breakeven to run a sustainable operation. The time spent doing other works should not be at the expense of machine time that should be operationalized to produce services to generate revenue. The R&D section has an affinity to find excuses for their failures in generating intellectual properties that should be breaking even.

Figure 6: Revenue & Expenditure of Divisions as a % ITI Total 2015-2020 (Nov) without Absorbing Overheads	Figure 7: Revenue & Expenditure of Divisions as a % ITI Total 2015-2020 (Nov) after Absorbing Overheads
	

The review team acknowledge the fact that the ITI officers have been invited to national development activities where the ITI has not been able to account for such time spent. However, the ITI has to restructure and reorganize itself to generate income for sustainability.

The two figures above shows the situation before absorbing overheads and after absorbing overheads. The ITI cannot run overheads at the government expense. The organization must make the services generate income through an intelligent strategy that is unique in the context of their premier status in Sri Lanka. That kind of proactive outgoing nature of business acquisition strategy should be primed in the ITI.

The original information given to the review team showed that Technical Services Division generated 73% of the total revenue during 2015 to 2020 (Nov). However, after the evaluation of the data those data have now changed to show 100% recovery. However, when overheads are absorbed this becomes 77% recovery. All other revenue generating divisions are incurring expenditures in excess of their revenue generation capacity. The chart shows the relative position.

Intra-Divisional Structure Of Earnings.

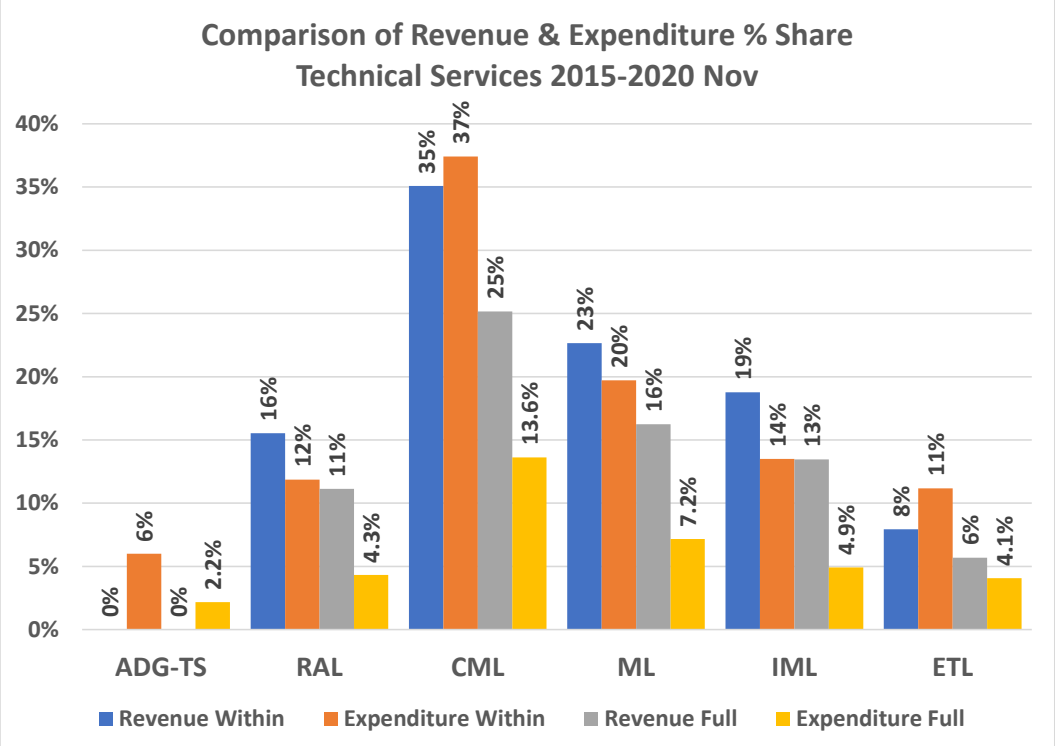
The intra division situation is depicted in the charts below.

The charts below indicate the outcomes of years 2015 to 2020 Nov.

In the discussions below we discuss the recovery of expenditure at the ITI divisions and subdivisions. Recovery is the percentage of direct income generated compared to the direct expenditure incurred in generating such income. The overheads of the organization are not included in the recovery %.

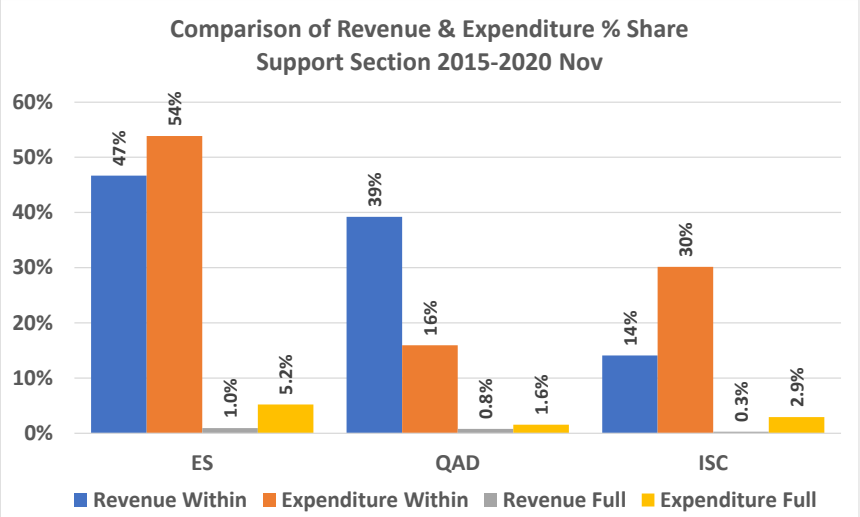
Intra Technical Services.

Figure 8: Intra Technical Services Comparison of Revenue and Expenditure



Accordingly, within Technical Services the situation of ML, IML and RAL are positive while CML has to improve on productivity within. ETL has to improve on performance within. All the subsections have contributed positively to the overall share of revenue within ITI. The Figure 7 shows the comparative situation within where for example CML spends 37% and recovers 35% during the 2015-2020 Nov period. CML spends 14% and recovers 25% of the ITI total expenditure and total revenue. Similarly, this analysis is presented for RAL, ML, IML and ETL. The RAL, CML, ML, IML, and ETL have contributed to the recovery of the ITI total expenditure

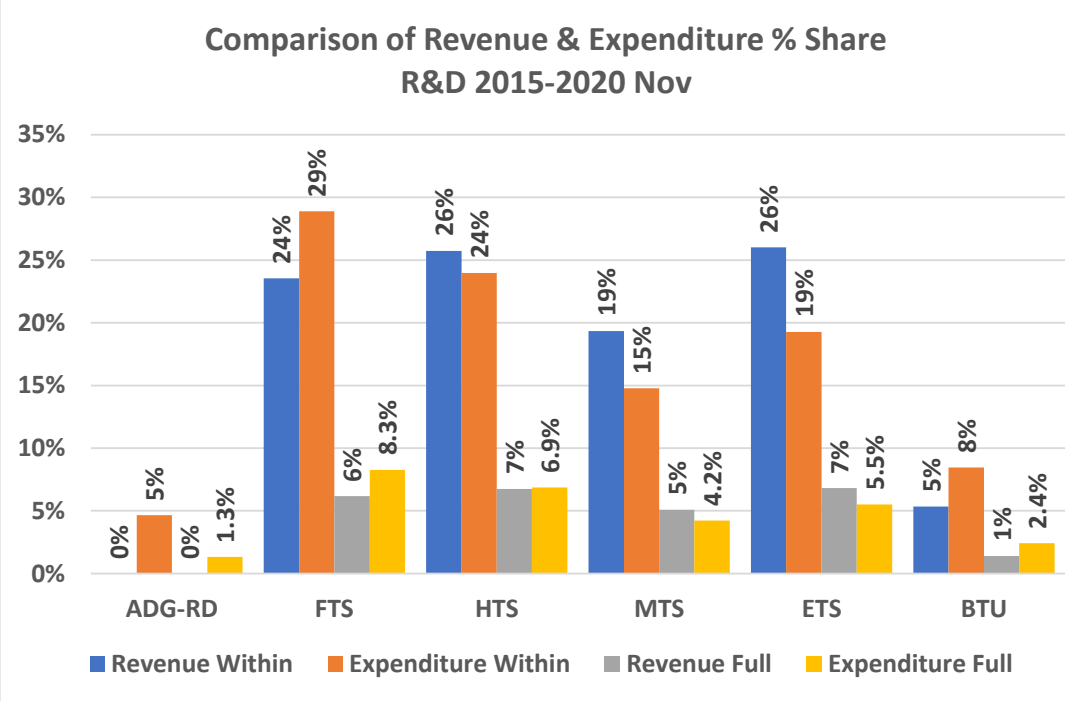
Figure 9: Intra Support Section Comparison of Revenue & Expenditure



11%, 25%, 16%, 13%, and 6% while the shares of their expenditures have been only 4.3%, 13.6%, 7.2%, 4.9%, and 4.1%. In the figure 7 this situation is depicted at a glance.

Intra R&D Division.

Figure 10: Intra R&D Comparison of Revenue and Expenditure



R&D Division has five subdivisions FTS, HTS, MTS, ETS and BTU. The FTS revenue is 24% of the division revenue while their share of the R&D Divisional expenditure is 29%. Likewise, HTS is 26% to 24%, MTS is 19% to 15%, ETS is 26% to 19% and BTU is 5% to 8%. Then when we compare the revenue and expenditure to the total ITI revenue and expenditure the situation with FTS is 6% to 8.3%, HTS is 7% to 6.9%, MTS is 5% to 4.2%, ETS is 7% to 5.5%, BTU is 1% to 2.4%.

Intra Support Section.

The revenue and expenditure of ES, QAD, ISC, units within the support section are respectively 47% to 54%, 39% to 16%, and 14% to 30%

In considering the overall income and expenditure of the ITI these three subsection have generated and spent ES 1% to 5.2%, QAD 0.8% to 1.6%, and ISC 0.3% to 2.9%,

Intra Administration.

Administration and Finance Division is a cost center and serves the overall organization by facilitation of business with information and pecuniary control.

There are ten subdivisions namely, ADG-AO, HR, FIN, Stores, Supply, Comp Unit, IA, MKT, Transport, and General. There had been a Productivity subdivision which did not appear in the last three years. The total expenditure of Administration is 22.5% of the total ITI expenditure. The other subdivisions are spending within the Administration division as follows: ADG-AO 5.3%, HR 11.0%, FIN 12.8%, Stores 5%, Supply 7.3%, Comp Unit 5.6%, IA 4%, MKT 6.5%, Transport 17.8%, and General 24.3%. Relative to the total ITI expenditure these are compared as: ADG AO 1.2%, HR 2.5%, FIN 2.9%, Stores 1.1%, Supply 1.6%, Comp Unit 1.3%, IA 0.9%%, MKT 1.5%, Transport 4%, and General 5.4%. There are no norms to compare with as overheads but one thing is clear that MKT as a proactive team should be spending more in terms of generating business for the ITI.

Figure 11:Intra Administration Comparison of Revenue and Expenditure

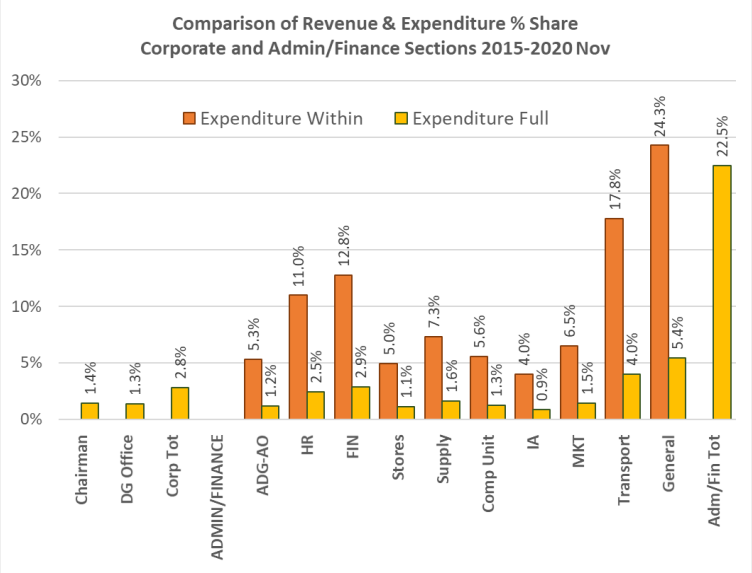
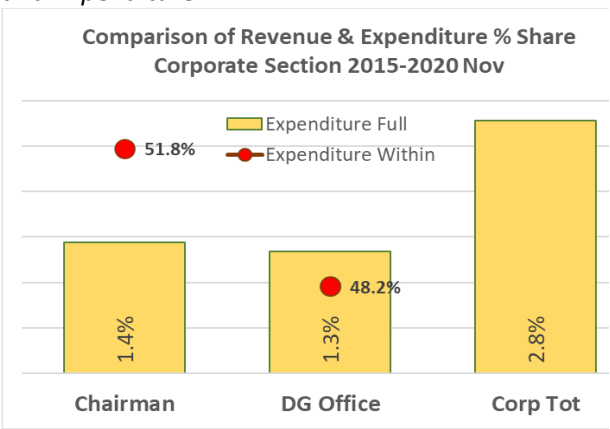


Figure 12: Chairman & DG, Comparison of Revenue and Expenditure



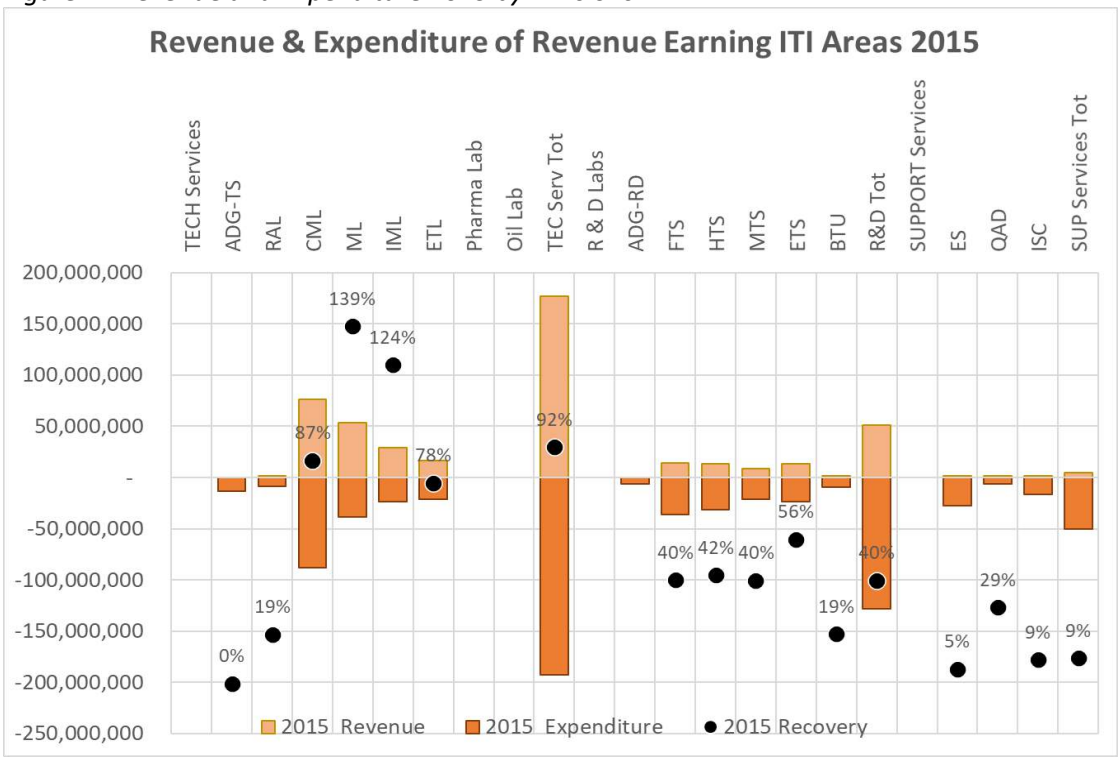
Chairman and Director General.

The Corporate Section has the Chairman and the DG. Their expenditures are more or less equal being 51.8% and 48.2% while as a whole they spent 1.4% and 1.3% of the total expenditure of ITI that makes up 2.8% of the total expenditure.

Comparison of Revenue and Expenditure intra ITI by Year.

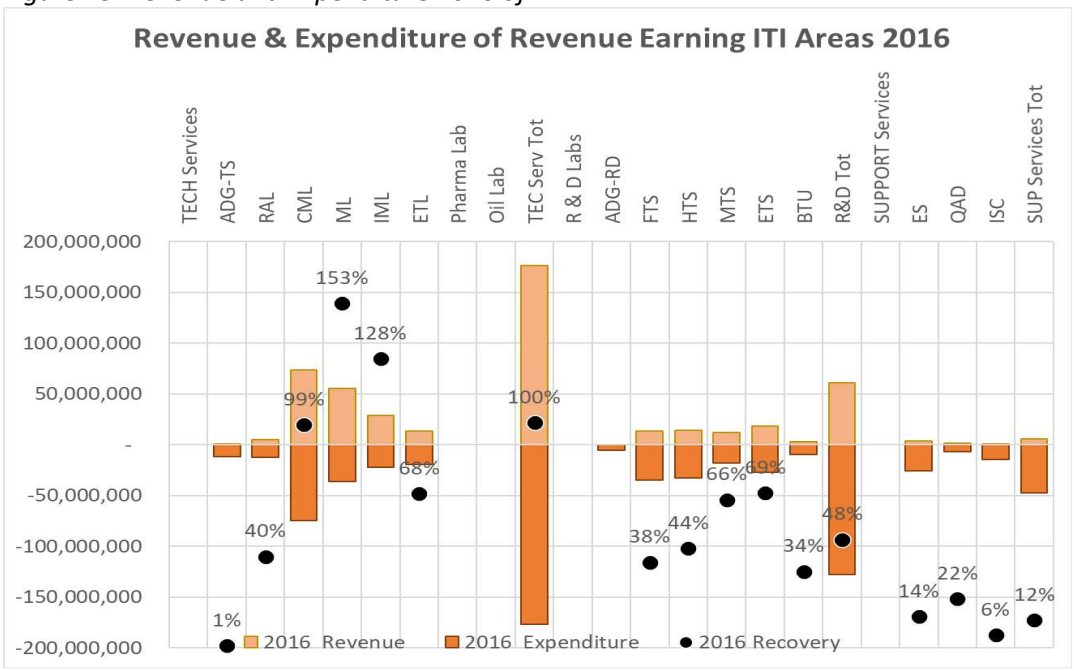
The following charts represent the revenue and expenditure in Rs millions of all subdivisions and divisions categorized by divisions. Each chart represent the data for one year. The figure

Figure 14 Revenue and Expenditure 2015 by Divisions



12 represents the expenditure and revenue during the year 2015 and shows the recovery % by the dots. The year 2015 saw an overall recovery of 49% The ML, IML, have made full recovery of expenditure. TEC Serv had 92% and R&D had 40% recovery levels.

Figure 13: Revenue and Expenditure 2016 of ITI



The figure 13 represent the situation in 2016. ML and IML have fully recovered while CML came close to full recovery with 99%. The TEC Serv division recovered their expenditure while R&D recovered only 48%. The overall recovery at ITI during 2016 was 53%.

Figure 15: Revenue and Expenditure 2017 of ITI

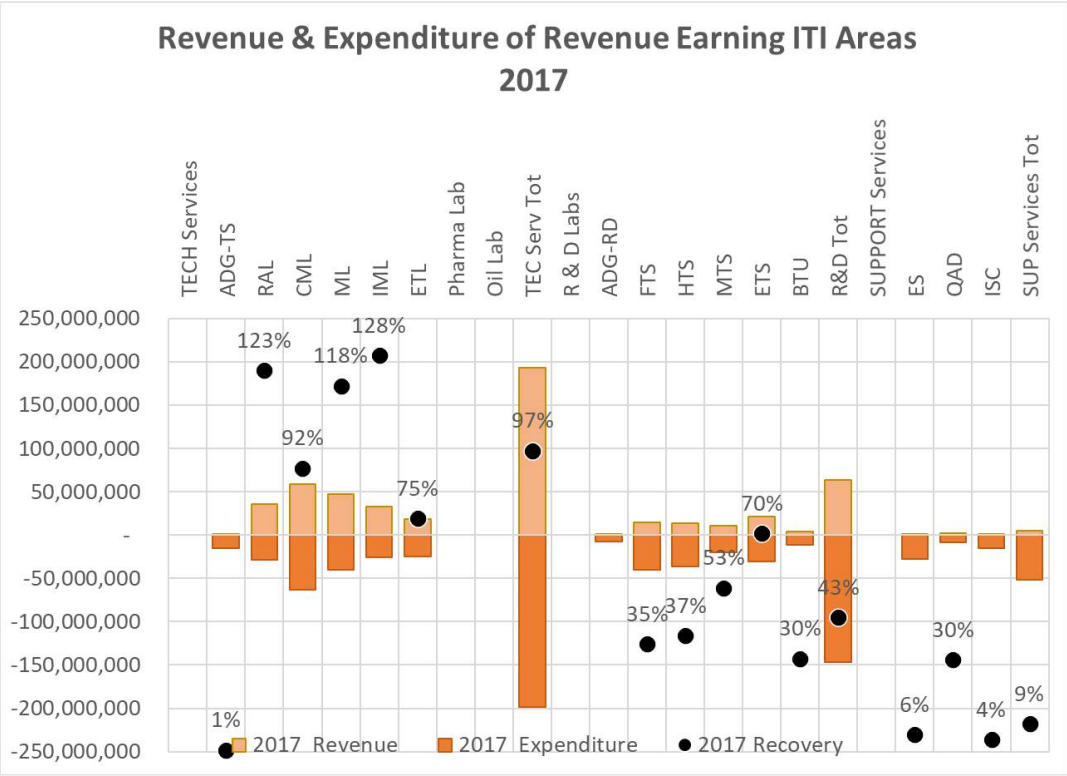


Figure 14 reflects the situation that prevailed in 2017. RAL, ML and IML fully recovered their expenditures. TEC Serv division managed 97% while R&D managed 43%. The overall ITI had 50% expenditure recovered in 2017.

Figure 16: Revenue and Expenditure 2018 of ITI

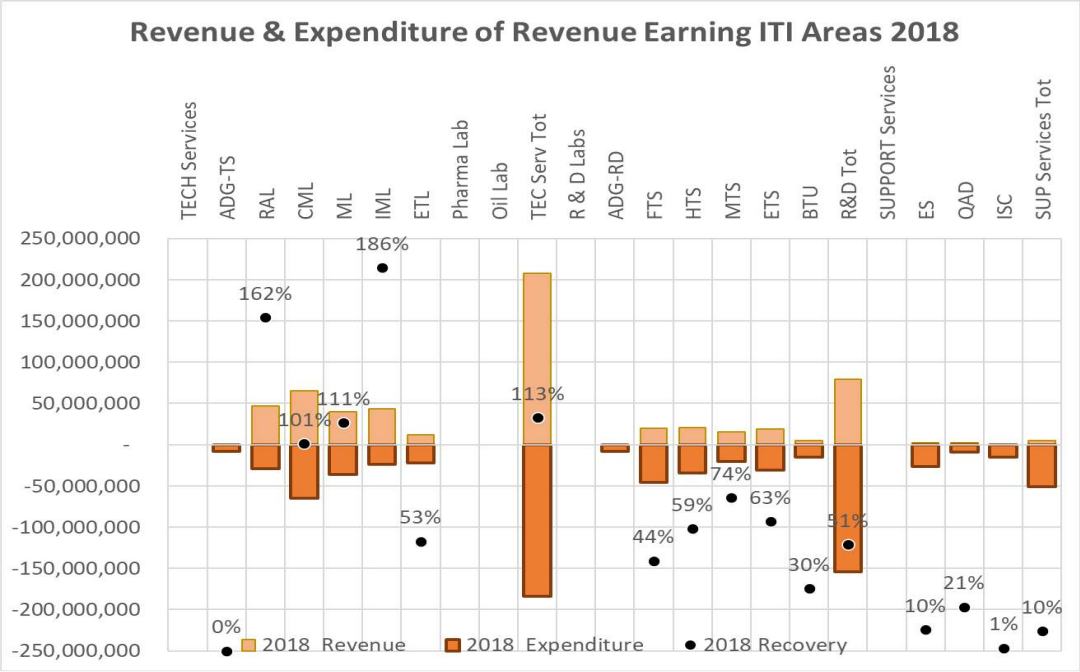


Figure 15 shows the year 2018 was relatively better in recovery due to more subdivisions coming into full recovery status. RAL, CML, ML, and IML, made full recovery. The Technical Services Division recovered 13% over and above their direct expenditure while R&D performed at 51%. The gross recovery rate for the year was 55% for the ITI.

Figure 17: Revenue and Expenditure 2019 of ITI

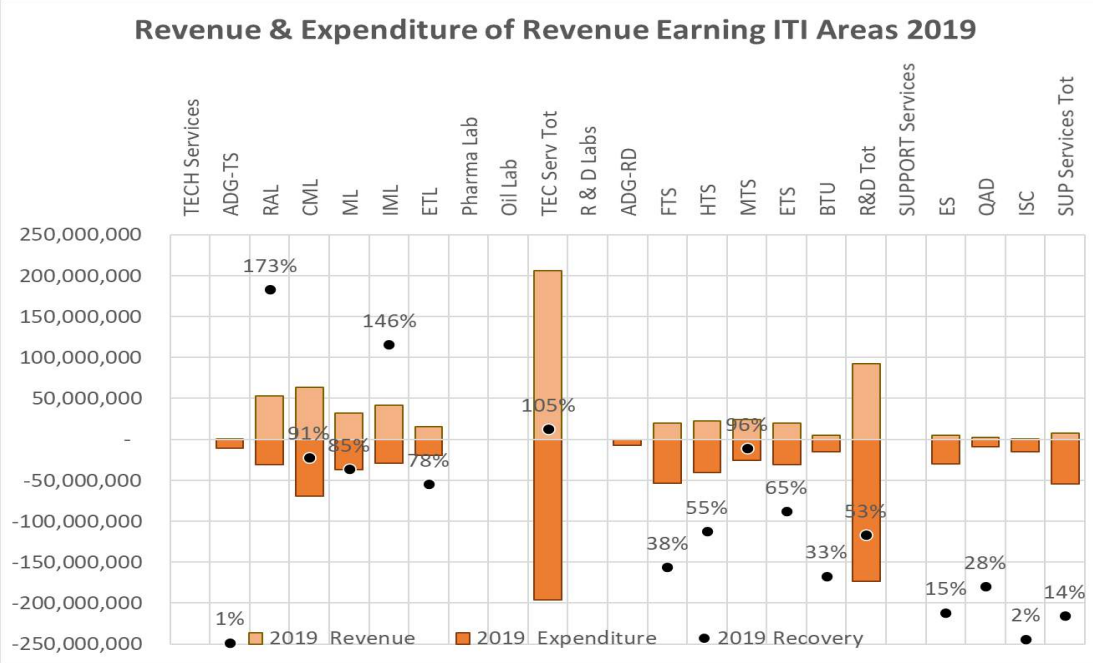
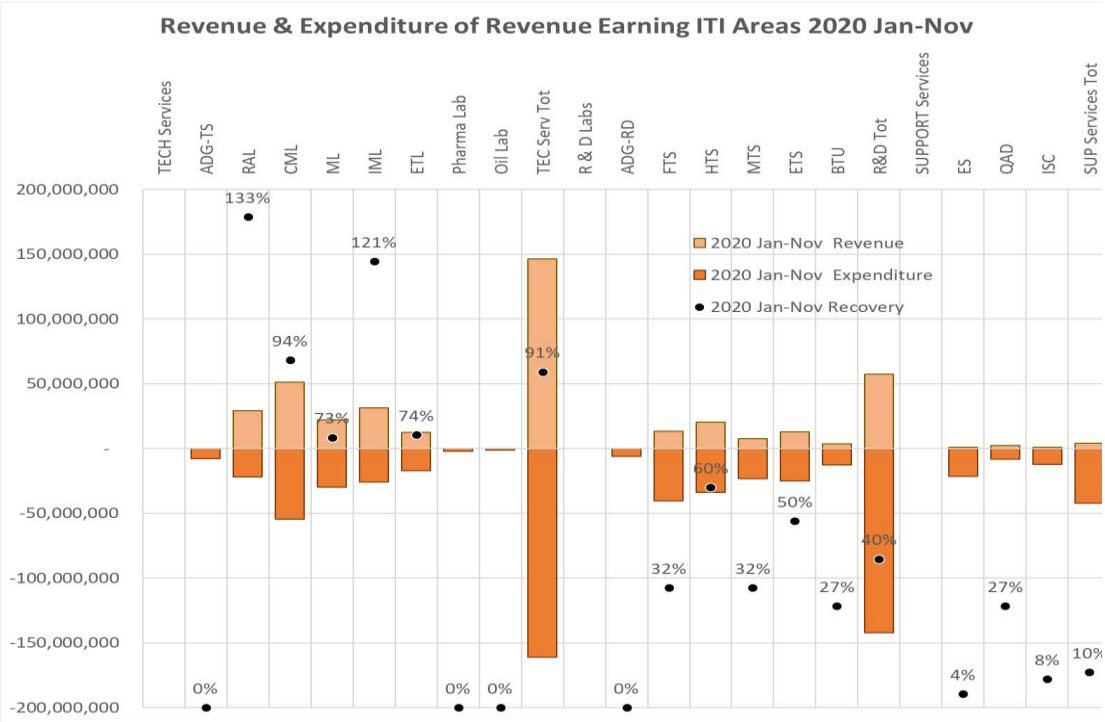


Figure 16 is an illustration of the situation in 2019 when ADG TEC Serv contributed positively with 105% recovery with RAL. However, CML, ML and IML fell behind. The TEC Serv fully recovered while R&D had 53% and fell behind. The ITI had 52% recovery during the year 2019.

Figure 18: Revenue & Expenditure 2020 Jan-Nov



Covid-19 struck in the year 2020. We have data from 2020 Jan to Nov. It is depicted in Figure 17 that Technical Services Division recovered 91% of direct expenditure while all other divisions performed poorly with Research and Development recovering 40%.The gross recovery rate of ITI for the year was 45%. There may be incomes accrued but not accounted and hence this picture should be seen as an indication of the situation which may change. Among the subdivisions only RAL, IML, managed full expenditure recovery.

These numbers of recovery indicate that only the Technical Services Division gets closer to justifying the expenditure incurred in their activities of customer services. The Research and Development Division fell behind by 54% during the review period. Both divisions are falling short when it comes to absorbing the overheads such as the Corporate, Administration and Finance Divisions. The Support Services have to improve on their valuation for internal work to gain more contribution in value. The overall situation is poor from the recovery point of expenditure since it reflects the productivity is below 50%.

Table 18: The Revenue and Expenditure by percent of ITI.

Revenue Earning Division	% Recovery without OHs	% Recovery with Ohs Abs
TECH Services		
ADG-TS	0.3%	0.2%
RAL	131%	98%
CML	94%	70%
ML	115%	86%
IML	139%	104%
ETL	71%	53%
Pharma Lab		
Oil Lab		
TEC Serv Tot	100%	75%
R & D Labs		
ADG-RD		
FTS	38%	28%
HTS	50%	37%
MTS	61%	45%
ETS	63%	47%
BTU	29%	22%
R&D Tot	46%	35%
SUPPORT Services		
ES	9%	7%
QAD	26%	20%
ISC	5%	4%
SUP Services Tot	11%	8%

Contribution from Divisions, Sections and Units.

The table 17 illustrates the relative recovery of the revenue earning divisions at ITI during the review period.

Technical Services Division manages to recover their expenditure during the review period without absorbing overheads. The overheads taken into account the situation of recovery is 75%. The R&D Division recovers 46% of expenditure without absorbing overheads and 35% after absorbing overheads.

Among the sections RAL, ML, and IML have generated revenue in excess of their direct expenditure before absorbing overheads while only IML has succeeded in full recovery after absorbing overheads. RAL has come closer at 98% after taking overheads. Others have to improve on their productivity.

The HR is integral to the ITI operations and long term sustainability. While we discuss the HR Division strategy elsewhere in this report from a financial view point it incurred 2.5% of the total expenditure (Figure 18).

Another integral part of the ITI is MKT and it incurred 1.5% of the total expenditure. Relatively MKT appears to be spending below the level of comparable services in organizations. MKT is connecting the customers to the production through the entire value chain of the ITI and should play a valuable role. We discuss the role of MKT elsewhere in the report.

Figure 19: Overhead % at IT 2015-2020Nov

Overheads	Overhead %
CORP DIVISION	
Chairman	1.4%
DG Office	1.3%
Corp Tot	2.8%
ADMIN/FINANCE	
ADG-AO	1.2%
HR	2.5%
FIN	2.9%
Stores	1.1%
Supply	1.6%
Comp Unit	1.3%
IA	0.9%
MKT	1.5%
Transport	4.0%
Productivity	
General	5.4%
Adm/Fin Tot	22.5%

The IA is a section that should be playing a major role within ITI. It incurred 0.9% yet it is without a head and does not seem to play a preventive role in the ITI. Instead attends to post event audits and perhaps attending to meetings requirements of the Audit Committee.

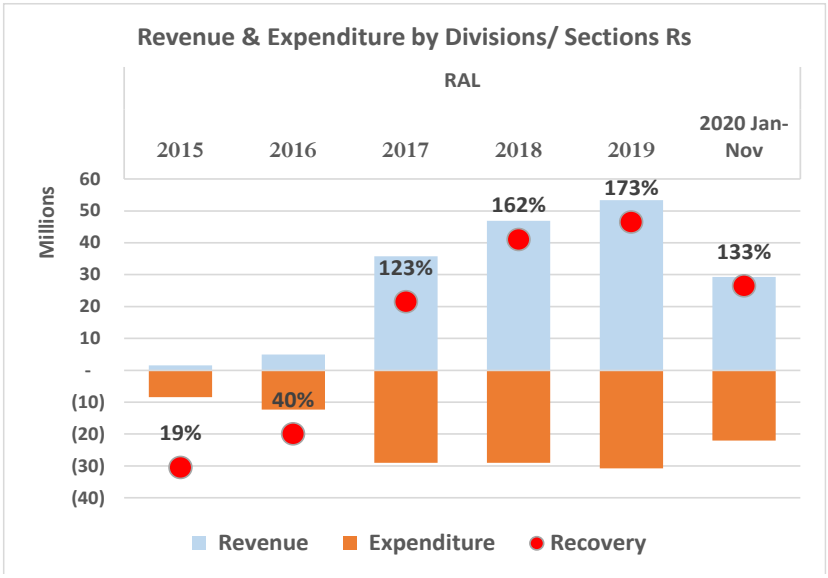
Technical Services Division Contribution.

The following charts show the track record of the income generating sections within the ITI during the review period of 2015 to 2020 (Jan – Nov).

The ADG Technical Services is not directly exploring income but however during 2019 there has been income with a surplus of 73%.

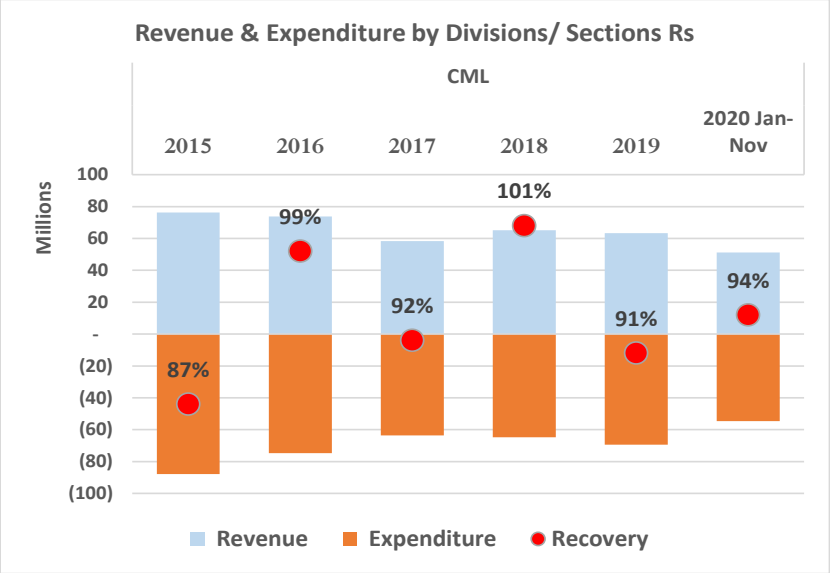
There are revenue earners under ADG TEC Serv. Residue Analysis Lab is one section that earns revenue.

Figure 20: RAL Revenue and Expenditure 2015 - 2020 Nov



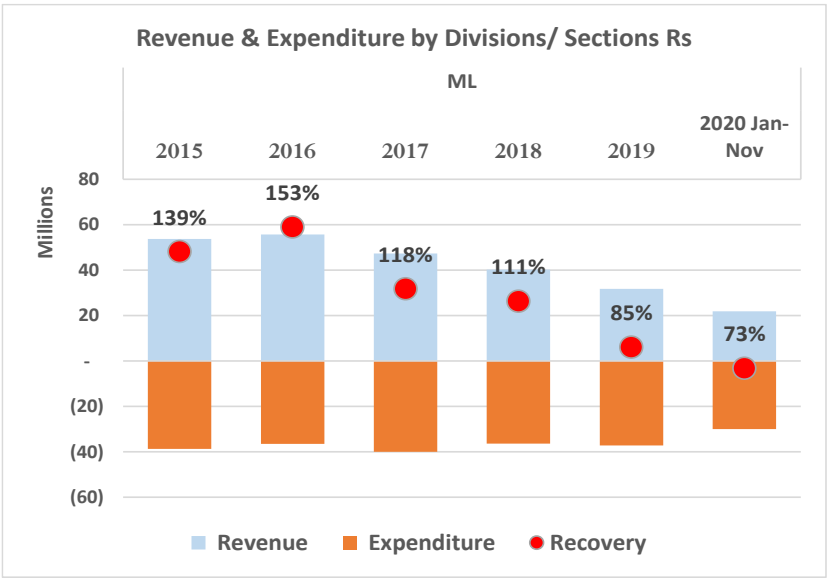
The RAL laboratory has performed well to generate revenue in excess of its expenditure during 2017 to 2020 (Nov). RAL is in a state of increasing contribution having gradually increased over the five years from 2015 to 2019. The growth is seen from their recovery of 19% in 2015 to 173% in 2019. The pandemic has apparently adversely affected in 2020, yet RAL recovered 133%. As it appears RAL is one of the most promising areas of expansion for ITI.

Figure 21 CML Revenue and Expenditure with Recovery%



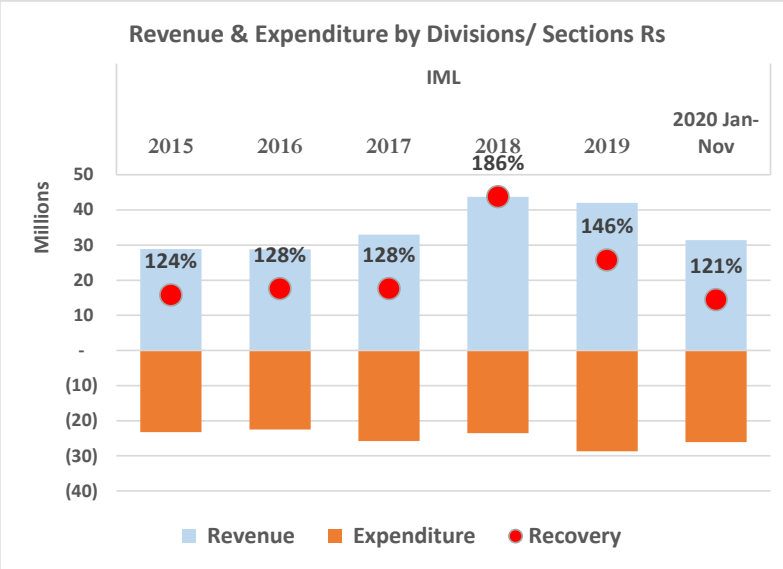
CML laboratory is a potentially high contributor that works very close to near full recovery. It has generated revenue in excess of expenditure in 2018. CML came closer to breaking even in 2016 as well but finished up with 99% recovery. This laboratory should be examined to improve on contribution.

Figure 22: ML Revenue and Expenditure with Recovery %.



The ML laboratory did well to generate surpluses from 2015 to 2018 but failed in 2019 and 2020 (Nov). ML shows signs of gradually diminishing recoveries. There should be reasons for this decline that should be examined. From 153% recovery in 2016 it reduced to 85% in 2019 and 73% in 2020 (Jan – Nov). This is a decrease of more than 50% and should come under investigation closely to regain their usual high level of performance.

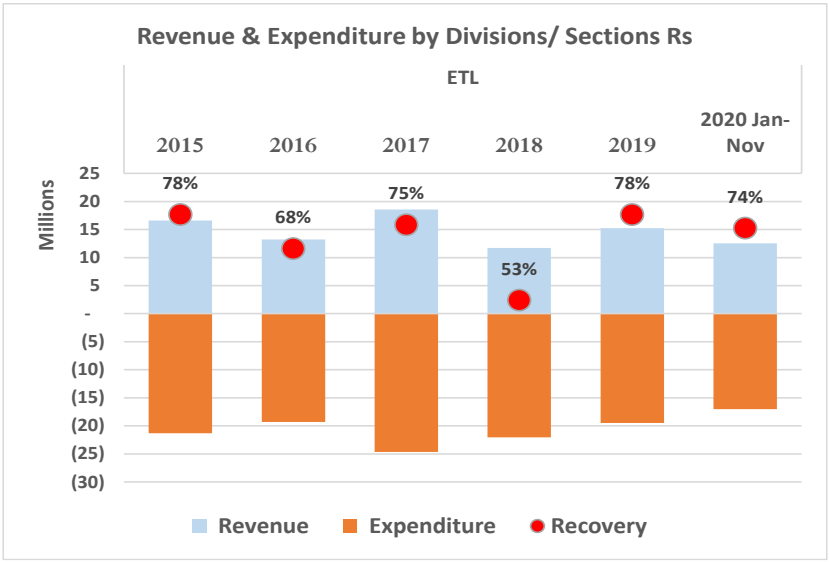
Figure 23: IML Revenue and Expenditure with Recovery %.



IML laboratory has performed well throughout the years since 2015 by recovering over and above their expenditure. The scale of spending capacity is between Rs.20–30mil. There is a marked reduction in the level of recovery from 2018 at 186% to 146% in 2019. The causes of such reduction should be examined and remedied.

.

Figure 24: ETL Revenue and Expenditure with Recovery %.

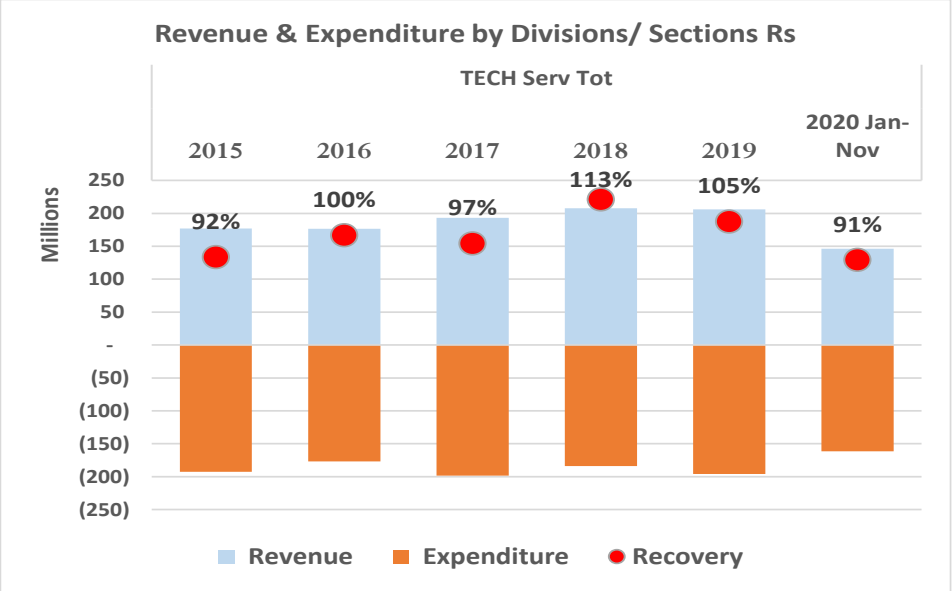


ETL laboratory has not generated revenue to justify the expenditure right through the review period. It appears that this laboratory has not exceeded recovery beyond 78% level. Again, this too must be examined and remedied.

.

.

Figure 25: TEC Serv Division Revenue and Expenditure with Recovery %.



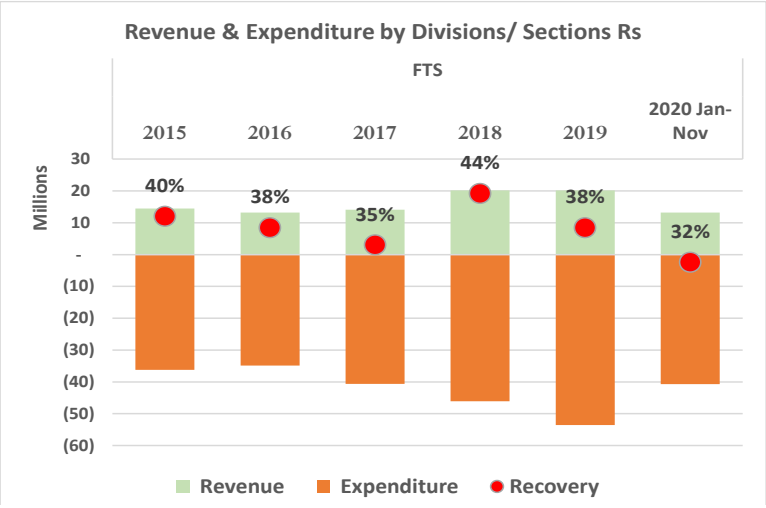
The Technical Services Division is the main breadwinner of the ITI and the main service provider for their customers. They generate revenue to sustain the ITI at least to the level of recovering their direct expenditure. The Technical services had breakeven success in 2016 and exceeded expenditure in 2018 and 2019. There was a decrease in recovery in 2019.

In 2015 and 2017 it has not been successful in achieving a full recovery of expenditure. 2020 outcome is yet to be seen. ITI should examine ways of improving on expanding tech services by upgrading their laboratories and replacing older with new equipment and getting the business development sections to proactively support this division to become a high level 'Cash Cow'.

R&D Division Contribution.

It was mentioned before that the R&D Division has to perform better to improve on their revenue generation. The following charts show the achievements in each year from 2015 up to 2020 Nov.

Figure 26: FTS Revenue and Expenditure with Recovery %.

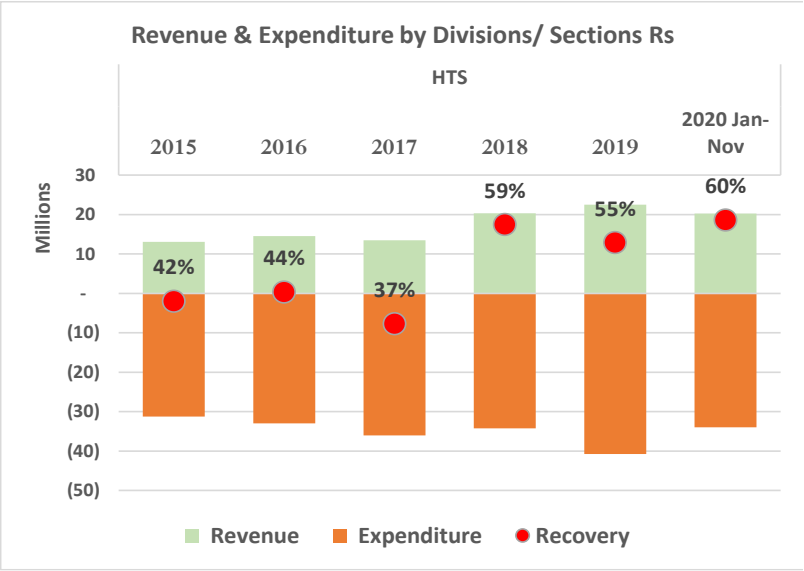


The FTS has been performing around 35% to 44%% recovery level. The 32% recovery in 2020 up to Nov is yet to be seen whether improved.

The business model in the R&D divisions has to be relooked to ensure that contribution is delivered in each year of

operations from the past R&D activities. Otherwise, it is a question as to how any division having such valuable physical assets and capable HR should be operating at levels below full recovery.

Figure 27: HTS Revenue and Expenditure with Recovery %.

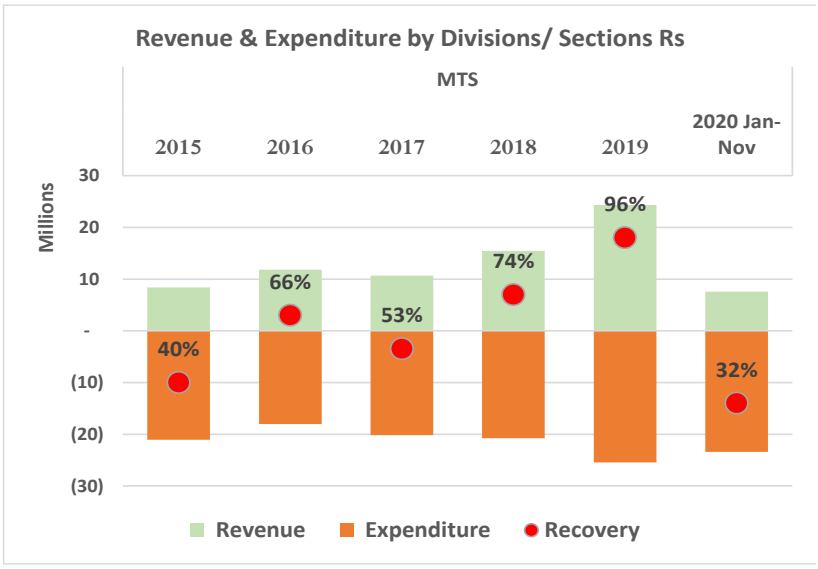


The HTS has been achieving between 37% to 60% recovery during the review period. The highest recovery made in 2020 is to be confirmed after the total year data are taken.

The general comments as stated in the FTS applies here as well. The business model has to be relooked at.

.

Figure 28: MTS Revenue and Expenditure with Recovery %.



MTS has a strong trend that shows its capacity to recover operational expenditure. Starting at 40% level of recovery in 2015 MTS reached 96% in 2019 and by far the best performer though its scale of operation is around Rs.25mill in the best year. The year 2020 has affected operations negatively .

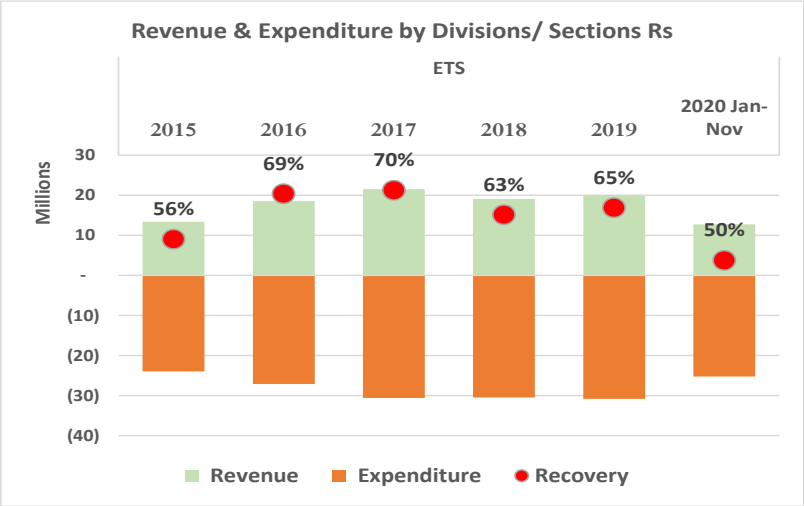
.

.

.

.

Figure 29: ETS Revenue and Expenditure with Recovery %.



.

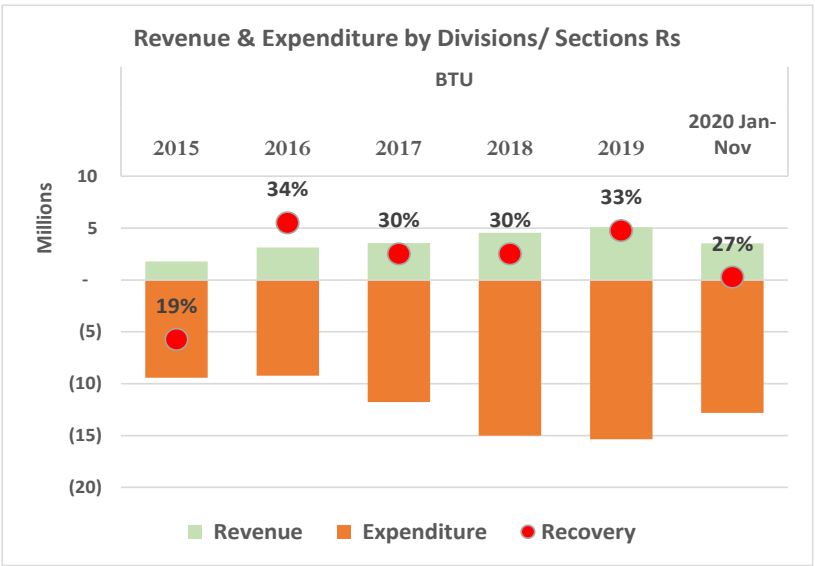
ETS managed to recover between 56% (2015) to 70% (2017). The year 2020 has affected negatively. The potential of the ETS division is to spend around Rs.30 mill annually. It should be examined and supported to recover the full amount.

.

.

.

Figure 30: BTU Revenue and Expenditure with Recovery %.



BTU has recovered from 19% in 2015 to stay around 30% to 34%. Year 2020 has affected negatively.

This section too needs to be examined closely as to why they continue with such low recovery levels..

.

.

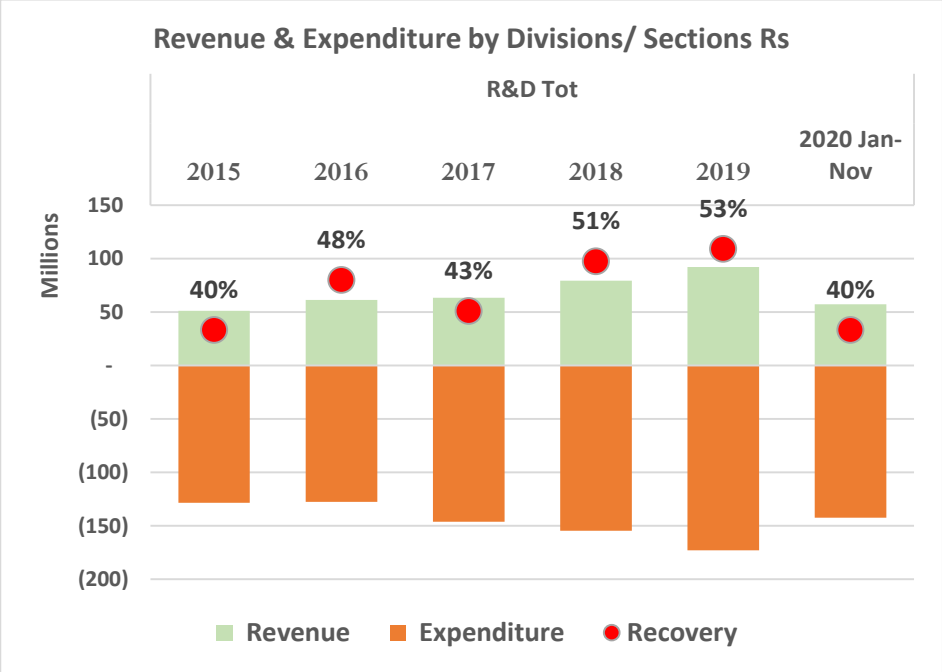
.

.

.

.

Figure 31: R&D Revenue and Expenditure with Recovery %.



As a division R&D failed to recover full expenditure anytime during the past six years. It has a variability of recovery from 40% in 2015 to 53% in 2019. In the year 2020 so far, it has recovered 40%.

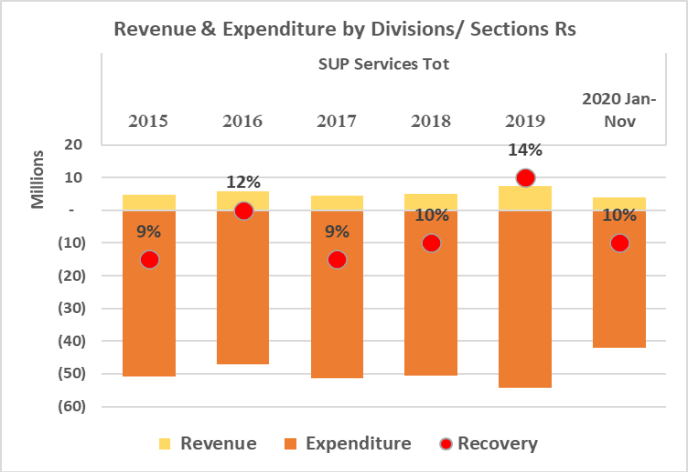
The R&D division states that they continue to support national projects and participate in various meetings at national level which do not get accounted for in rupees and cents. Participation in meetings and performance and research & development are two mutually separate activities. The review team holds that the performance of research activities are not up to the level of producing high economic value. Had it been a single year it could be seen differently. It is the practice of the R&D Division to run their subdivisions at low levels of productivity.

The idea of introducing a new business model was mentioned earlier. It could also be possible for all the labs to be treated as revenue generating labs under the technology division and to provide the resources of the Tech Service when R&D projects are being implemented by the Research Scientists. The Researchers should then be able to account for the work they do in the laboratories from a capacity utilization perspective.

None of these changes would make it possible to gain full recovery of expenditure within Tech Services and R&D without a proper integrated digital network that links all equipment to the users and managers. The digital systems should also be capable of picking up usage, users, types, down time, maintenance, costs, etc. This is an issue that ITI has to tackle very soon with the ICTA.

Support Services Division Contribution

Figure 32: Support Services Revenue and Expenditure with Recovery %.

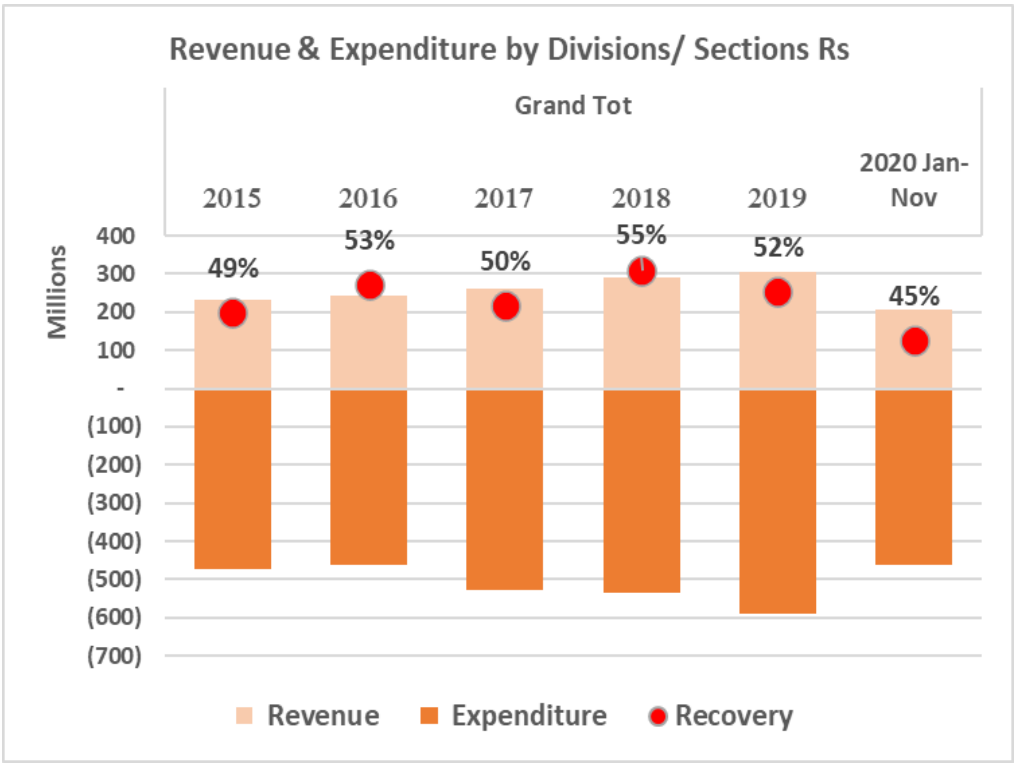


The Support Services constitute of ES, QAD and ISC subsections. The revenue earned compared with the full ITI revenue in these subsections are ES 1.0%, QAD 0.8%, ISC 0.3%, and Support Services Total 2.1%. The expenditure incurred are ES 5.2%, QAD 1.6%, ISC 2.9%, Support Services Total 9.7%.

As whole Support Services have recovered around 9% to 14% of their expenditure. As such it is clear that the support services do not assess their contribution to justify their expenditure. Valuation of services is a sure way to recognize the importance of contribution and gain better control and accountability of services.

The Overall Recovery Performance.

Figure 33: ITI Grand Total Revenue and Expenditure



ITI has been successful in recovering between 49% to 55% of expenditure until Covid struck in 2020. It recovered 45% up to 2020 Nov. It clearly appears from the trend during the past

six years that the ITI is working on a recovery level or around 50.6%. The ITI believes that the remaining 49.4% is the ITI's contribution to national development at various forums and meetings with high level government officials. This is not acceptable. ITI has been empowered by their mandate to charge commercial rates from their customers. The government pays the ITI such commercial rates in getting their technical services. It is in the R&D division that this problem arise due to the laxity in organizing the recoveries by giving it high priority. As we have suggested earlier under the R&D Division Total contribution it would be a positive change to provide services to R&D work by the Tech Services. The ITI could place all laboratories under the Tech Services for them to plan and generate income to recover full costs including overheads while sourcing the laboratory services to the R&D Division for specific research work.

The first step in such a transformation of placing all laboratories under the Tech Services Division would be to ensure that all labs breakeven at their direct expenditure levels and to follow up with absorbing all overheads involved in running all operations.

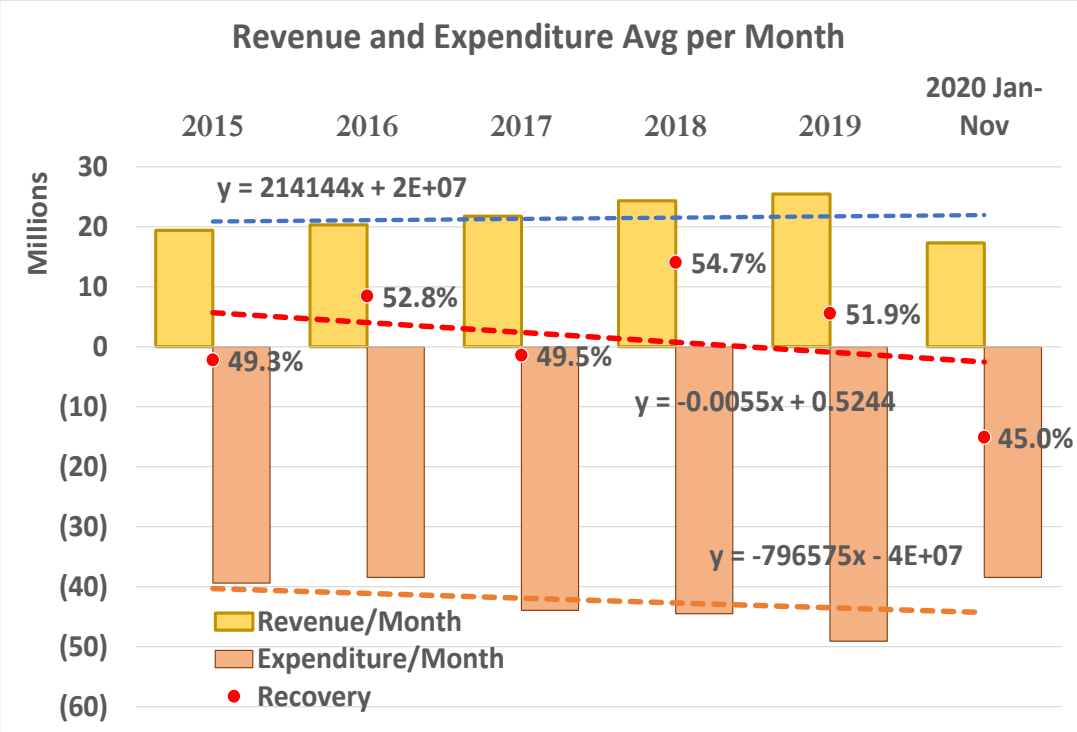
We also strongly advice ITI to quickly establish a digital networking system within ITI to facilitate information flow from the laboratories to the management and those who use the labs. It would also push information to the customers on their requirements. The laboratories can be better driven as testing facilities and providing services to R&D for research work where the research workers can account for their usage. The system should thus develop to make all activities accountable. Else the ITI and those responsible at higher levels are managing by hearsay.

The total recovery situation is not getting improved in a way to develop confidence in the near future. The chart below illustrate the trends in monthly revenue and expenditure over the six years. The revenue generated can be expressed in a linear mathematical model as $y = 214144x + 2E+07$ where y is the total revenue per month and x is the year in which we are operating starting at 2015 (=1).

The trend in the expenditure incurred can be expressed in a linear mathematical model as $y = -796575x - 4E+07$ where y is the total expenditure per month incurred and x is the year in which we are operating starting at 2015 (=1).

Based on these statistics we can expect the rate of annual increase of expenditure to be around Rs.10 million while the annual increase in the revenue generated is around Rs.3million. This is based on the review period trend devoid of any specific strategic action taken to increase revenue and thus it is likely to continue in the same manner if nothing changes. Even though it appears mild the fact that there is no significant improvement has to be taken note. Accordingly, unless a change is done in the system of operations it would continue to incur losses. The losses incurred in 2020 would be around Rs.280million according to the trend. The recovery rate in 2020 is expected to be around 48% as the trend goes.

Figure 34: Total Revenue and Expenditure of ITI Average per Month Rs.



Revenue from Activities.

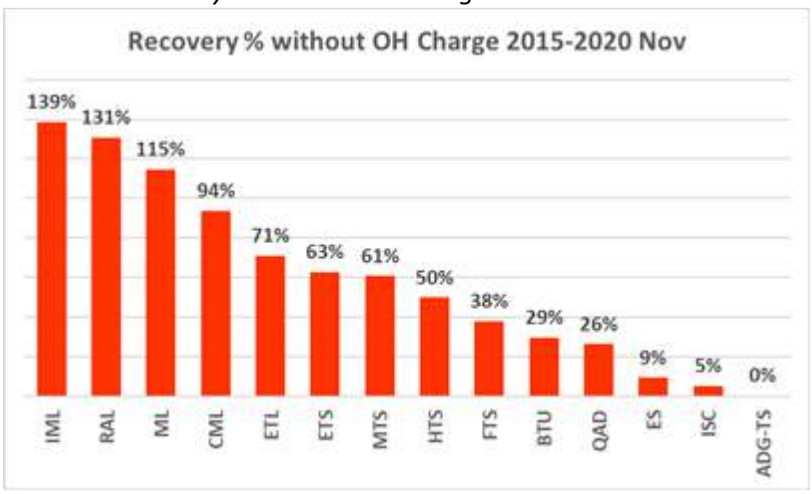
The Corporate Plan 20-24 that was made available has some relevant data on recovery. It is given in the table below.

Table 19: Revenue Earned (Corporate Plan 2020-2024).
Rs. Million

Activity	2017	2018	2019
Standard Services	178.79	196.60	172.05
Consultancy Services	20.71	22.80	28.53
Technology Transfer	2.77	3.20	7.51
Contract Projects	26.08	29.30	56.86
Customized Services	18.83	17.30	19.71
Training Programme	13.80	19.90	18.10
Total	260.98	289.10	302.76

Recovery Comparison.

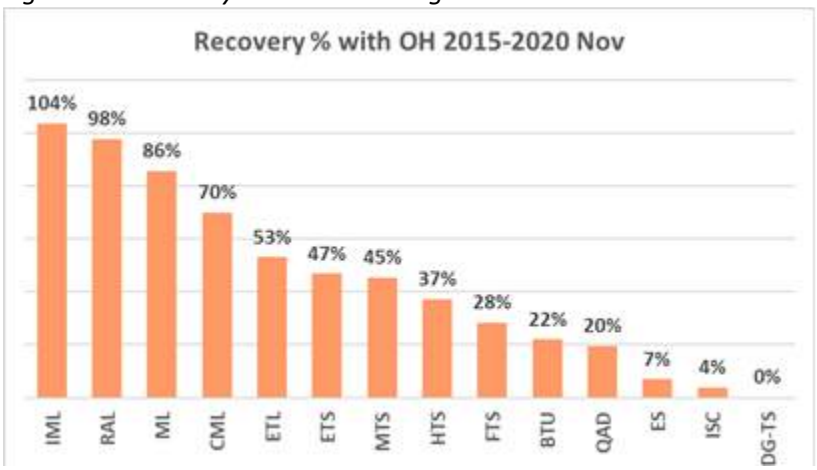
Table 20: Recovery % without OH Charge 2015-2020 Nov



This chart depicts the recovery rates of each laboratory or section during the period 2015 to 2020. The recovery percentages are relative to the amount spent by the laboratory or the section and the amount earned as revenue generated within the laboratory or section.

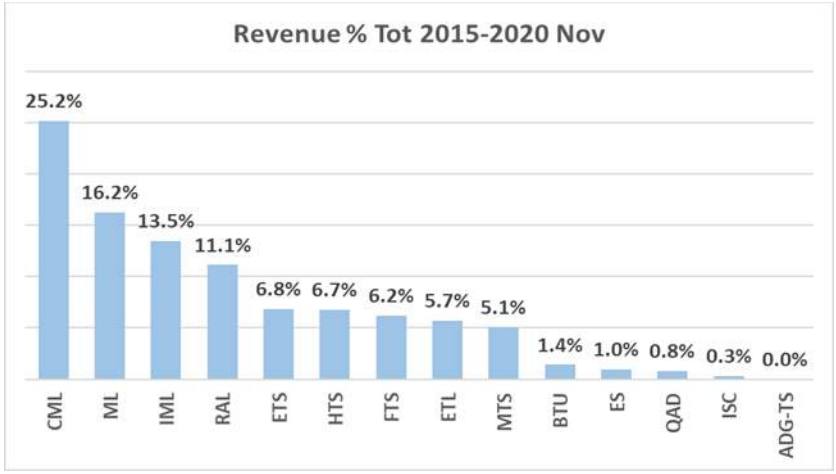
It shows as percentages IML, RAL, ML have recovered while CML reached 94% fully while all others are not breaking even. This is the picture before absorbing overheads.

Figure 35: Recovery % with OH Charged 2015-2020 Nov



The figure here goes to illustrate what happens to the recovery rates when overheads are taken into account. Only IML has reached the full recovery at 104% while RAL has come close at 98%. This chart clearly illustrates that strategically ITI needs to rethink their business plan to achieve a full breakeven operation.

Figure 36: Revenue % of the Total 2015-2020 Nov Comparison

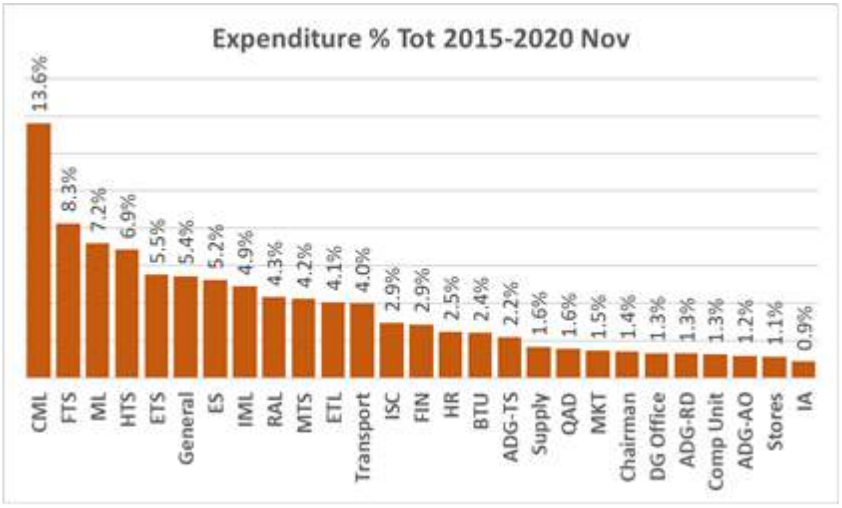


Revenue Comparison.

The revenue % is relative to the total revenue earned during 2015-2020 by the particular laboratory or the section. Accordingly, CML, ML, IML, and RAL are the top four revenue earners with over 10%. These divisions have to collectively earn twice as much to break even as an institution.

Expenditure Comparison.

Figure 37: Expenditure % of the Total 2015-2020 Nov Comparison



The expenditure % of the laboratories are relative to the total spent during the period 2015-2020 by all the laboratories and sections.

Accordingly, CML, FTS, ML and HTS are the highest spenders.

From among the overheads Transport, Finance, and HR are leading. Whether overheads are excessive or not is not a question here since we cannot benchmark these expenditure.

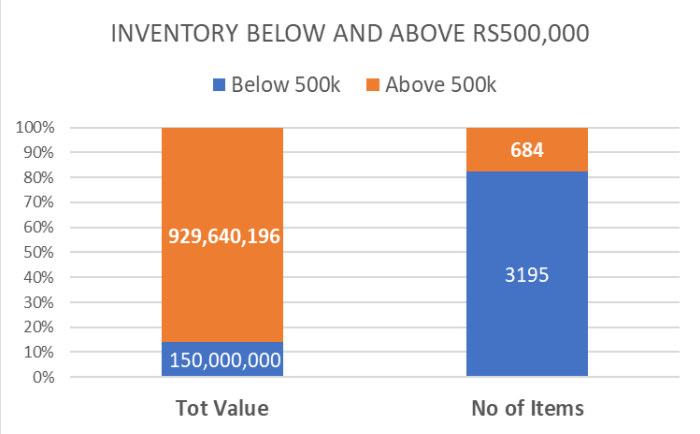
Equipment Value Analysis.

The main equipment/ instruments available in the institute are as follows.

- Chromatographs: GC with FID, ECD, NPD, TCD; GC-MS WITH EI/CI; HPLC with DAD, RI and fluorescence detectors, LC/MS/MS, ICP/MS, capillary electrophoresis, amino acid analyzer, purge and trap, thermal de-sobers.
- Spectrophotometers: FAAS, GFAAS, FT-IR, UV-VIS, XRF.
- Industrial metrology: Standard platinum resistance thermometer, solid state voltage standard, multi product calibrator, mass comparators, gauge block comparators.
- Others: Scanning electron microscope, dust monitors, emission monitoring equipment, flue gas analyzers.
- Pilot plant units: Multi-purpose extractors, wiped film evaporator, continuous extractor, spray dryer, membrane filtration unit, vacuum evaporator, twin extruder, retorts, jacketed kettle, cream separator centrifuge, colloidal grinding mill, dryers, universal mixers, filter press, ribbon blender, flour mill, coating drum, vacuum can sealer, slicer, vacuum sealer, can saw, bowl chopper, fruit pulper, soya milk processing unit, oil expeller, fermenters.

High Value Equipment.

Figure 38: Inventory values split at Rs.500,000.



The ITI is well equipped and the inventory of equipment is valued at Rs.1,079,920,245 for 3879 items in the inventory. There are 402 items that are of zero value probably due to depreciation.

ITI has many expensive equipment, particularly in the laboratories. An idea about the value of these equipment could be gained from the chart and more details follow.

Out of the total 3879 items there are 3195 items below Rs.500,000 with total value 150,280,048 while there are 684 items above with total value 929,640,196.

This represents a 17.6% of the items carrying a value of 86% very much reminding us of the 80:20 principle. Thus, we need to focus more on the 17.6% of the items to keep them intact for high value work. It is particularly important to give high value equipment more attention that is included in the 50% of the value in 2.9% of the total amount of equipment.

Location of Equipment Valued Above Rs.10 million.

The highest value 12 equipment are listed below and the value range from Rs. 47.6 mill to Rs. 10.7 mill. These assets have a value of Rs.237,374,427. There are other high value assets and the distribution is as follows.

Table 21: High Value Inventory Assets (top 12):		
Asset	Location	Value Rs.
LCMS MS System with CPU, Monitor	Colombo 07	47,611,115
GCMS/MS EI System with CPU/monitor/printer/UPS	CML	33,511,509
X Ray Diffraction System, CPU, monitor	MT	20,870,726
ICP-MS System with accessories with CPU, monitor, printer, UPS	CML	19,884,279
Scanning Electron Microscope, with ASSE.	MT	19,275,000
Stack Air Quality Monitoring System	ETS	18,511,000
3 Phase Power Calibrator & High Current Adaptor	IML	15,767,570
FT-NIR Spectrophotometer with CPU, monitor, printer, UPS	Colombo 07	14,322,891
Fermenter, compressor, CPU, monitor, printer	5102	12,613,638
Meter Calibrator	IML	12,372,289
Serie Kin ZD IMNCLO.5 System	IML	11,927,728
Pilot Freeze Dryer	Malabe	10,706,681

.

Equipment Valued Below Rs.10 million to Rs.5 million.

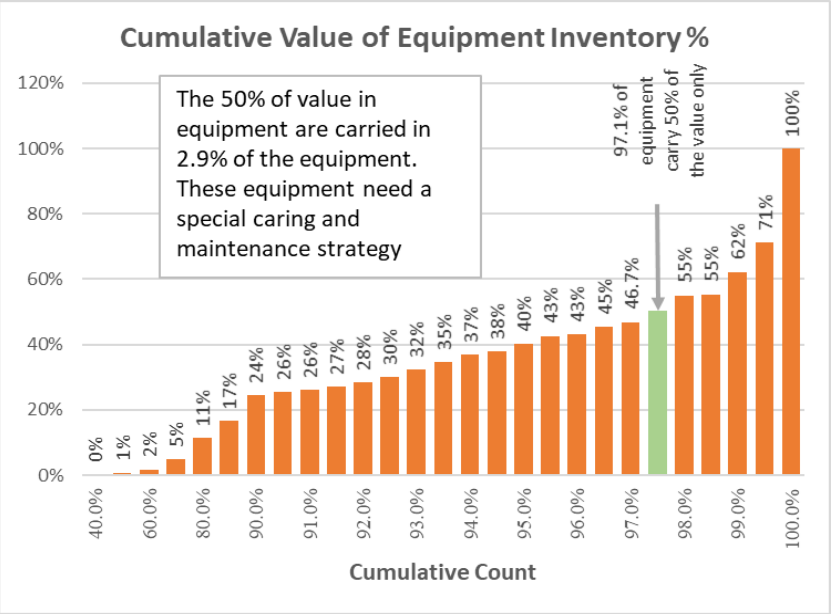
The next 24 items are between Rs.9.9mill and Rs.5.1mill and these assets have a value of Rs.175,559,342. All other equipment are below Rs.5mill.

Table 22: High Value Inventory Assets Rs5-10mill	
HPLC System with CPU, monitor, printer	9,911,992
UHPLC System+cpu+monitor+printer+detector+pump+auto sampler	9,664,626
Spectrometer XRE Energy Dispersive	9,562,605
Gas Chromatograph Mass Spectroscopy, CPU, Monitor Printer, UPS	9,355,700
High Performance Liquid Chromatography System. CPU, Monitor, Printer, Ups, HPLC Pump	9,218,047
Gas Chromatograph	8,567,840
Gas Chromatograph HP 6890 Plus	8,567,840
TLC Densitometer	8,485,500
HP 6890 Series GC Mass selective detector G1727A	7,754,720
Horizontal Dilatometer with Chiller, CPU, monitor, printer	7,721,841
Testing Machine Universal, Instron 1000 KN test system, Computer System	7,417,620
HPLC System	7,256,054
Water Purification System	7,203,980
Freeze Dryer with vacuum pump	6,842,235
Rheometer Torque, Electronic, CPU, MONITOR	6,509,722
Vibration Analyzer	6,243,310
Spectrophotometer With CPU, Monitor, Printer, Ups	6,211,834
Chromatograph High performance liquid, CPU, Monitor, Printer, Pump	5,975,000
Universal Testing Machine	5,956,250

Generator Diesel	5,761,600
Gas chromatograph With Ups	5,699,400
Dissolved Air Floc	5,294,400
Fully Automated Food Fibretech 8000 System	5,210,227
Microscope Research	5,167,000

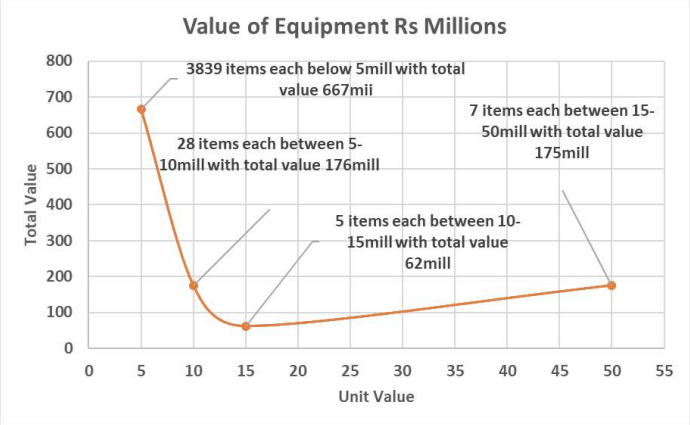
Equipment Valued Below Rs.5 million.

Figure 39: Cumulative Value of Equipment %



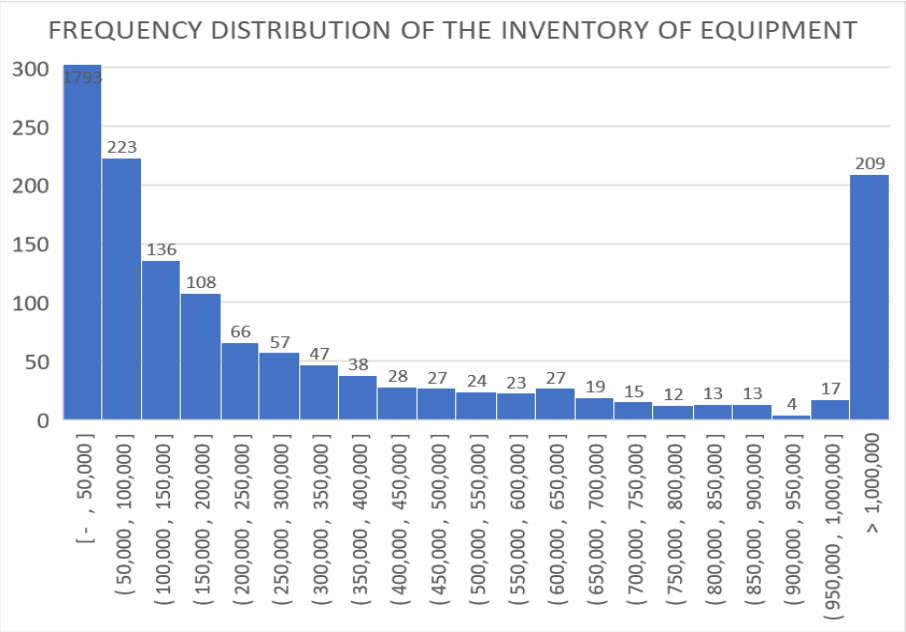
The distribution of values also could be shown in the following manner to improve on where to make higher efforts at maintenance.

Figure 40: Value of Equipment Above Rs.5mill.



Another perspective of the distribution from the values below Rs1.0million is below.

Figure 41: Frequency (y axis) of Inventory Value Rs. (x axis).



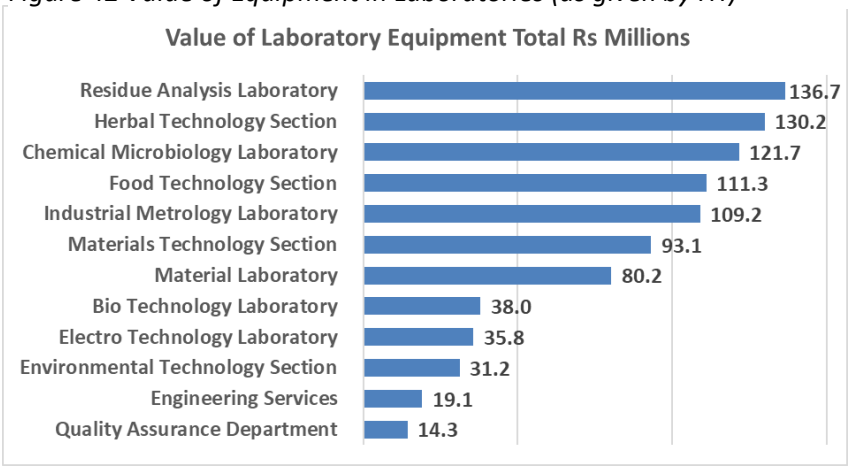
.

The equipment located in different laboratories are listed as follows by the ITI. There are five labs each with more than Rs.100 million worth equipment.

Location wise Distribution of Equipment.

The inventory database provided a method of identifying the value based on the location at ITI. Using this inventory data, we extracted some information of the high value locations. Accordingly, we have some more information laboratory wise with the following information.

Figure 42 Value of Equipment in Laboratories (as given by ITI)



.

.

.

Table 23: Location Related Count of Items and Value (extracted from the inventory database)		
Location A	Sum of Count of Items	Sum of Value Sum
CML	738	222,720,629
IML	582	113,319,653
Herbal	154	106,257,953
Food	451	101,308,097
ML	444	94,063,876
MT	171	93,372,572
Colombo 07	44	79,721,943
ETS	85	53,497,471
ETL	125	35,330,938
Malabe	21	32,514,891
ft	68	6,407,933
RAL	31	5,992,889
TC	31	2,958,183
QAD	17	2,673,059
SYN	2	1,952,134
HER	11	1,562,682
FIN	17	1,542,047
HR	26	1,397,929
Mal	2	1,033,547
QA	5	801,990
ETU	5	619,921
ISC	10	586,200
Eng	10	246,419
Food Mal	1	243,162
PHTG	5	120,000
Grand Total	3056	960,246,119

This list covers 3056 items with over Rs.960.2million value. There are other items but with the information we have those items cannot be given a location identity. However, some questions arise. We have need an explanation for CML indicated to have Rs.222.7mill equipment while the other list shows Rs.121.7mill.

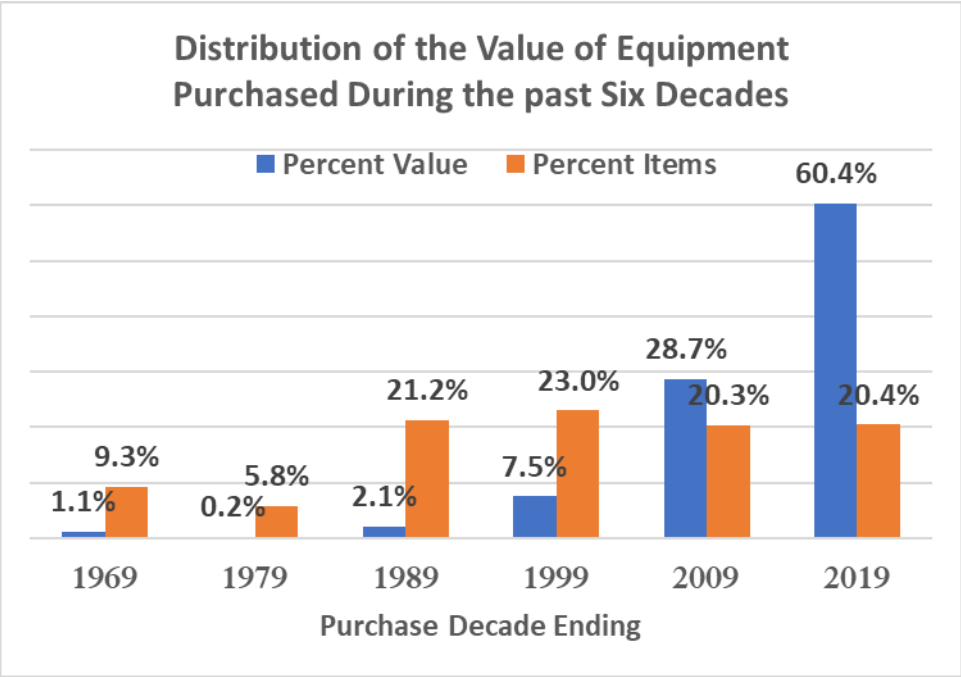
Note: Similarly, questions arise on the other values given in the figure 41 which is based on a summary made available while the tabulation above is listing directly from the inventory database.

Equipment Age Analysis

The ITI equipment age distribution is depicted in the chart below showing that 20.4% of equipment have been purchased during the decade ending 2019. Of course, relative to the value of equipment purchased since 1960 the value of purchases during the last decade is 60.4%. The rupee value of purchases is relatively high since the exchange rate had escalated and the rupee depreciated immensely during those years. All remaining equipment amounting 79.6% of the total are more than 10 years old. And the age varies from 1960-2009. This is clear evidence that this analysis indicates the need to upgrade all labs. In making decisions on lab upgrading, meaning buying modern equipment, first priority should be given to customer demand areas where higher revenue can be targeted instead of merely replacing older equipment. This could be determined by carrying out an ROI on every investment over

rupees one hundred thousand. Sometimes when equipment clusters contribute to the outcomes of testing. In such cases the value of the cluster could be taken to consideration in reporting on feasibility and ROI. It should also be noted that usually the whole set of equipment in a cluster need not be replaced but only a fraction. Yet the value addition is in the whole operation involving the cluster and therefore the ROI should consider the entire cluster by taking the assessed value and the productivity of the cluster.

Figure 43: Distribution of the Rupee Value of Equipment Value and Age at the ITI



The analysis shows that during the period 2010 to 2019 the labs have been updated. Nevertheless, the fact remains that 80% of equipment are more than 10 years old. Thus, it is imminent that ITI should revisit equipment replacement policy to upgrade their institutional technology.

Table 24:Equipment Purchases During 2010 to 2019

Year	Value Rs.	No of Items
2010	3,044,997	18
2011	40,682,267	69
2012	59,260,677	124
2013	60,161,825	98
2014	68,824,871	72
2015	89,301,750	127
2016	80,625,846	69
2017	98,395,963	88
2018	98,857,690	119
2019	53,313,783	46

Customer Value.

Customers are the reason for ITI's existence. The customer value creation capacity is the hallmark of success. ITI has a relatively large customer base. We studied the customers base through the transactions recorded during the past four years provided by the ITI. We analyzed the invoice values and the number of invoices by the different types of customers. Some of the basic statistics from 2017 to 2020 are produced below.

Table 25: Transaction Value by Customer Type 2017-2020 Nov

Customer Type	Total Invoice Value in Millions	Total Invoice Value %
Private	569.1	51%
Individual	276.4	25%
Government	257.2	23%
NGO	8.9	1%
Foreign	5.2	0.5%
Total	1,116.7	100%

The table 6 shows the value by Customer Type. There are five types: Private, Individual, Government, NGO, and Foreign. The most lucrative is the Private customer with 51% of the business. Next are the Individual customers having 25% of the business and then the Government with 23% of the business. NGOs are 1% and Foreign customers have 0.5%. The rupee values are shown in millions. The total sales amount over the four years is Rs.1,116.7 million. (due to rounding there is a surplus of 0.5%).

Table 26: Transaction Value by Customer Level 2017-2020 Nov

Customer Level	Total Invoice Value in Millions	Total Invoice Value %
Large/Corporate	522.4	47%
Micro Enterprises	70.8	6%
SME	523.5	47%
Grand Total	1,116.7	100%

The table 26 shows that there are three customer levels: Large/ Corporates, Micro Enterprises and SMEs. The Large Corporates and SMEs account for 47% each and Micro Enterprises account for 6% of the business.

.

.

.

Table 27: Transaction Value by Customer Category 2017-2020 Nov

Customer Category	Total Invoice Value in Millions	Total Invoice Value %
Deposit	15.2	1%
Occasional	359.5	32%
Regular	741.9	66%
Total	1,116.7	100%

.

Another classification is by Category and the three categories are Deposit, Occasional, and Regular. The Regular customers yield the largest value of business with 66% value while Occasional customers yield 32% leaving the Deposit customers with 1%. (due to rounding there is a 1% gap).

.

Customer Segments with Significant Value.

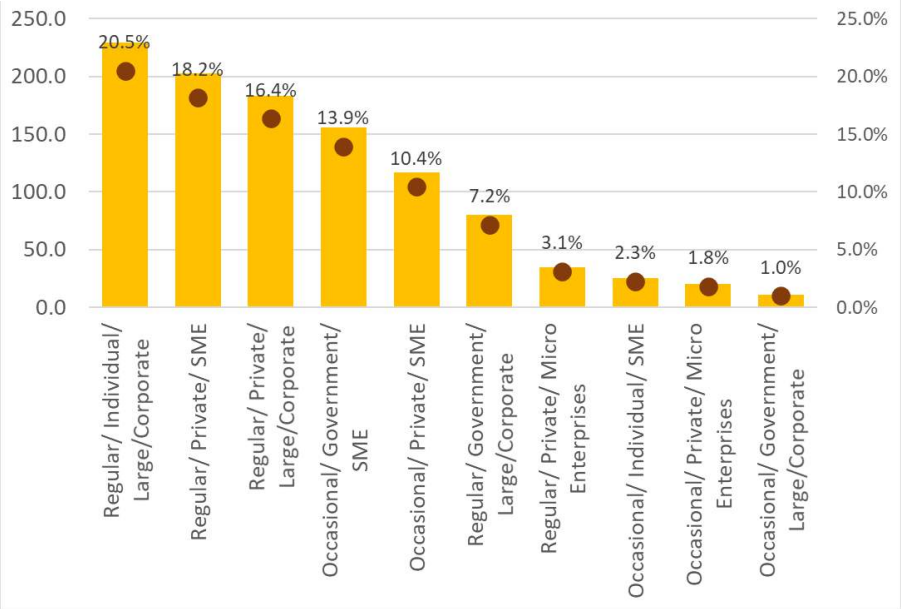
The following analysis is to show the high value customer segments according to ITI classifications.

Table 28: The Customer Segments of Significant Value (>1%) 2017-2020 Nov

Customer Category	Customer Type	Customer Level	Sum of Total Invoice Value in Millions	Sum of Total Invoice Value %
Regular	Individual	Large/Corporate	229.1	20.5%
Regular	Private	SME	203.0	18.2%
Regular	Private	Large/Corporate	183.0	16.4%
Occasional	Government	SME	155.7	13.9%
Occasional	Private	SME	116.7	10.4%
Regular	Government	Large/Corporate	80.0	7.2%
Regular	Private	Micro Enterprises	35.0	3.1%
Occasional	Individual	SME	25.3	2.3%
Occasional	Private	Micro Enterprises	20.6	1.8%
Occasional	Government	Large/Corporate	11.1	1.0%

.

Figure 44: The Customer Segments of Significant Value (>1%) 2017-2020 Nov.



The significant value brought is assumed to be above 1% of total invoice value of all transactions during the 2017 – 2020 Nov period.

The analysis shows the result shown in the table as well as the figure.

.

.

.

.

Checking the number of customers in these segments we find the following results for the entire population of customer segments.

Table 29: Customer Segment with Invoice Value and the Count of Customer Name

Customer Segment	Sum of Total Invoice Value in Millions	Count of Customer Name**	Total Invoice Value/No of Invoices
Grand Total	1,116.7	11,211	15,673
SEGMENTS OF HIGH VALUE			
Regular/ Individual/ Large/Corporate	229.1	1,490	13,351
Regular/ Private/ SME	203.0	2,811	13,538
Regular/ Private/ Large/Corporate	183.0	1,102	11,522
Occasional/ Government/ SME	155.7	221	110,441
Occasional/ Private/ SME	116.7	2,256	17,122
Regular/ Government/ Large/Corporate	80.0	121	18,753
Regular/ Private/ Micro Enterprises	35.0	463	12,949
Occasional/ Individual/ SME	25.3	1,149	13,741
Occasional/ Private/ Micro Enterprises	20.6	638	10,679
Occasional/ Government/ Large/Corporate	11.1	49	34,160
SEGMENTS OF MEDIUM VALUE WITH POTENTIAL			
Occasional/ Individual/ Micro Enterprises	8.9	496	11,398
Occasional/ NGO/ SME	8.5	16	23,723
Deposit/ Individual/ Large/Corporate	7.4	15	14,854
Deposit/ Private/ Large/Corporate	6.4	17	20,665
Regular/ Government/ SME	5.5	48	10,976
Occasional/ Foreign/ SME	4.5	28	43,608
Occasional/ Private/ Large/Corporate	3.1	50	7,505
Regular/ Government/ Micro Enterprises	3.0	12	138,441
SEGMENTS NEED DEVELOPING			
Regular/ Individual/ SME	2.9	110	13,560
Occasional/ Individual/ Large/Corporate	2.4	49	5,351
Occasional/ Government/ Micro Enterprises	1.9	25	24,622
Deposit/ Private/ SME	1.4	13	9,451
Occasional/ Foreign/ Micro Enterprises	0.7	10	23,521
Regular/ Individual/ Micro Enterprises	0.4	16	20,090
Occasional/ NGO/ Micro Enterprises	0.3	2	17,216
Deposit/ Private/ Micro Enterprises	0.0	1	32,500
Regular/ Foreign/ SME	0.0	1	16,000
Regular/ NGO/ SME	0.0	2	4,467

** The same customer may have appeared several times.

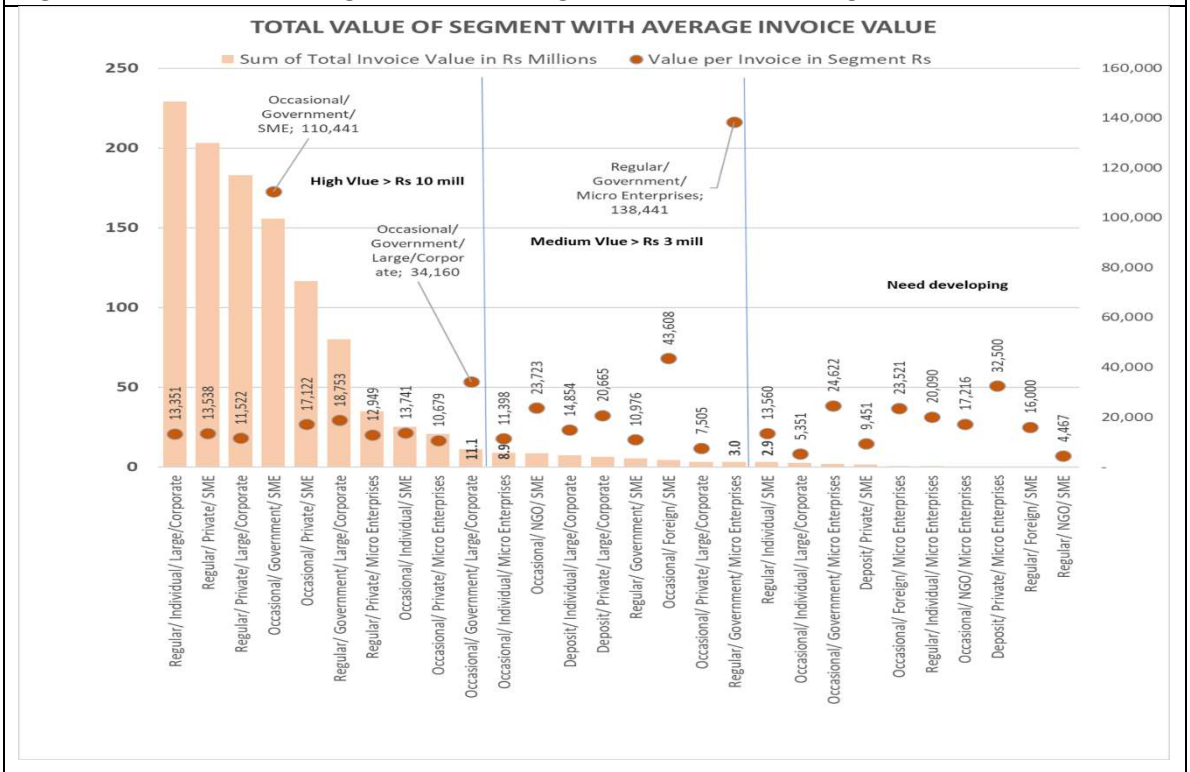
Figure 45: BCG Matrix

.

MARKET GROWTH			
	High	Determine if investment is needed to follow up with these customers. High Growth Low Share QUESTION MARK? DIVEST REMAINDER	Pay attention here. These are potentially very high value customers High Growth High Share STARS SELECT A FEW INVEST
	Low	It is difficult to profit from these customers. So best to see how to relate with them. Low Growth Low Share Low DOG POSSIBLY LIQUIDATE	These customers have to be watched as their market may not be growing any more. Technology support can change their business. Low Growth High Share CASH COWS
		Low	High
		MARKET SHARE	

Learning from the BCG matrix, it is timely for ITI to do a thorough study of the customers to understand their profitability and act on maximizing revenue while developing the market to gain better customers.

Figure 46: Total Value of Segment with Average Value of Invoice in Segment



According to above analysis we have identified the segment values based on the ITI classification. The high value group is above Rs3million for the four years while the medium value is above Rs.3million and below Rs.10.million. Those below the Rs 3 million mark need more work to identify their potential.

Transactions 2017-2020.

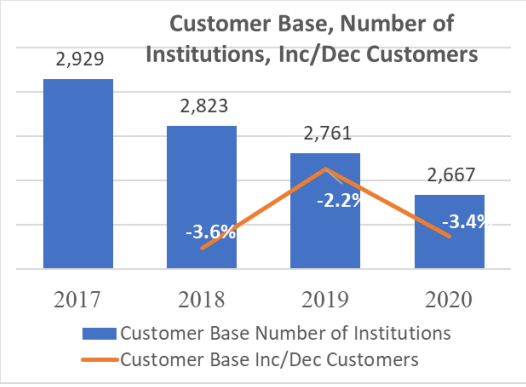
The transactions and the value of transactions recorded during past four years are given below with the changes from year to year.

Table 30: Customers and Transactions 2017-2020

Year	Number of Institutions	Inc/Dec Customers	Invoices	Inc/Dec Invoices	Value Rs	Inc/Dec Value
2017	2929		18,946		260,311,934	
2018	2823	-3.6%	19,455	2.7%	312,208,821	19.9%
2019	2761	-2.2%	18,006	-7.4%	323,398,285	3.6%
2020 (Jan-Nov)	2667	-3.4%	14,844	-17.6%	220,789,847	-31.7%
Total Transactions			71,251		1,116,708,887	
Average Value of a Transaction					15,673	

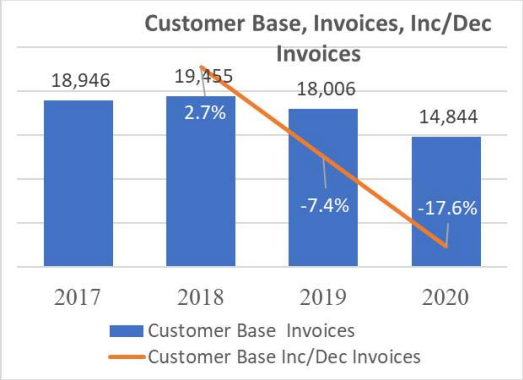
This indicates the compelling need to strategies to retain business with the existing customers and do more powerful customer relationship building. It also is complemented by the analysis under the revenue and recoveries.

Figure: 47 Customer Numbers 2017-2020.



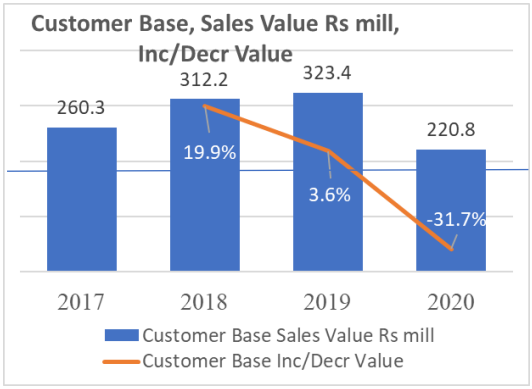
As seen here the number of customers be they institutions or otherwise have been decreasing year to year. 2018 by 3.6%, 2019 by 2.2.%, 2020 (Nov) by 3.4%. This is a decrease of 8.9% from 2017 to 2020.

Figure 48: Customer Transactions 2017-



However, the invoices indicating the number of transaction have increased 2.7% in 2018, decreased 7.4% in 2019 and decreased 17.6% in 2020. This is a net decrease of 21.6%. Perhaps the low level in 2020 is due to the prevailing Covid-19 epidemic.

Figure 49:Customer Value Rs Mill 2017-



The figures show the situation with the marginally reducing numbers of customers, reducing number of invoices, which means fewer transactions, and the increase in value of annual sales from 2017 to 2019.

The trend in transaction value showed revenue increase of 19.9% in 2018, increase of 3.6% in 2019, and a decrease of 31.7% in 2020.

.

Customer Value by Level with Category.

The following analysis is complementary to the analysis previous analysis with segments. The classifications of customers depending on their type, category and level. The distribution of the customers are as follows.

Table 31:Total Invoice Value % by Customer Level

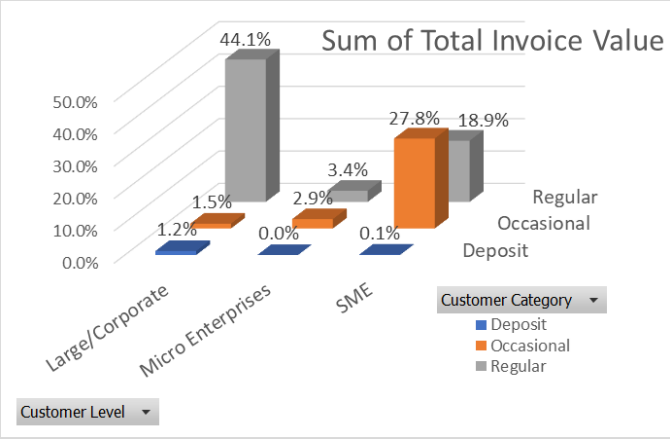
	Customer Category			
Customer Level	Deposit	Occasional	Regular	Grand Total
Large/Corporate	1.2%	1.5%	44.1%	46.8%
Micro Enterprises	0.0%	2.9%	3.4%	6.3%
SME	0.1%	27.8%	18.9%	46.9%
Grand Total	1.36%	32.20%	66.44%	100.00%

.

The Regular Large Corporates bring in 44.1% of the total value while SMEs bring in 32.2% as Occasional participants and 18.9% as Regulars with an overall contribution of 46.9%. It is to

be understood that there is great potential of business gaining from the SMEs as they have leveled with Large Corporates in bringing value to ITI.

Figure 50: Total Invoice Value (Level by Category).



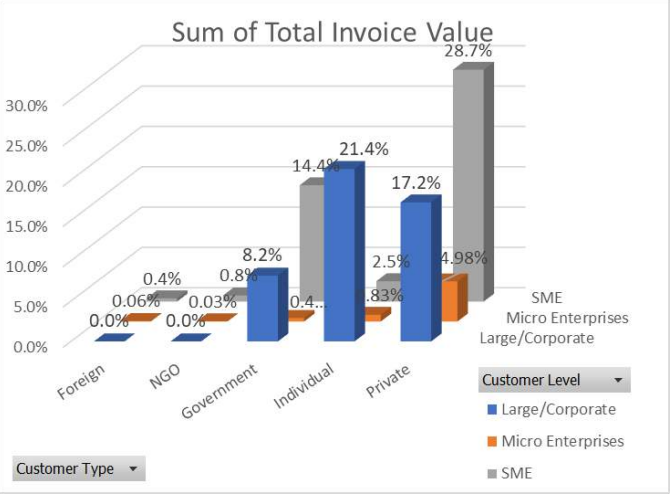
This figure 34 shows the high revenue customers in the ITI portfolio of customers.

Customer Value by Type with Level

Table 32: Invoice Value by Level and Category				
Sum of Total Invoice Value	Customer Level			
Customer Type	Large/ Corporate	Micro Enterprises	SME	Grand Total
Foreign	0.0%	0.1%	0.4%	0.46%
NGO	0.0%	0.03%	0.8%	0.79%
Government	8.2%	0.4%	14.4%	23.03%
Individual	21.4%	0.8%	2.5%	24.75%
Private	17.2%	5.0%	28.7%	50.96%
Grand Total	46.8%	6.3%	46.9%	100.00%

The table 32 shows the customer Type with the Level. Here we find there are Large/Corporates categorized as Individual Customers and they bring 21.4% of the business while the Private Customers from Large Corporates bring 17.2%.

Figure 51: Invoice Value Type by Level.



Private SMEs bring the largest share with 28.7%. It is to be noted that Government Category has SMEs who bring 14.4% value. Under this categorization Private customers have the biggest share with 50.96%. It is noted that NGOs and Foreign categories have below 1% share of the ITI business.

This figure is another presentation of the above table 32 to view the facts at a glance and get the feel of the scale of value classifications.

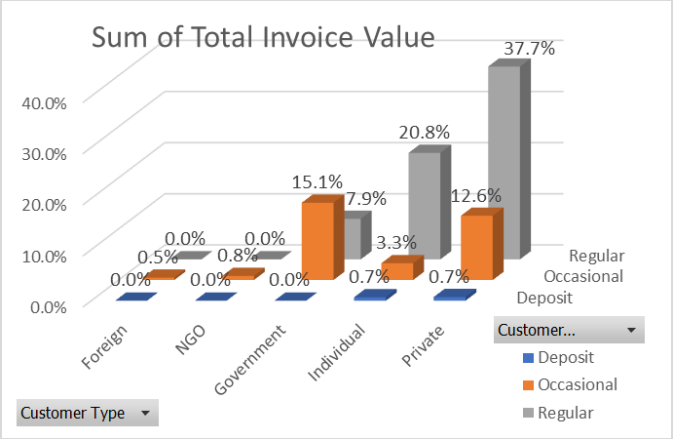
Customer Value by Type with Category.

Regular customers bring 66.4% of value while the contribution is highest from the Regular Private customers 37.7% while their counterpart Individual Customers also bring 20.8% of value.

Table 33:Invoice Value by Regularity

	Customer Category			
Customer Type	Deposit	Occasional	Regular	Grand Total
Foreign	0.0%	0.5%	0.0%	0.5%
NGO	0.0%	0.8%	0.0%	0.8%
Government	0.0%	15.1%	7.9%	23.0%
Individual	0.7%	3.3%	20.8%	24.7%
Private	0.7%	12.6%	37.7%	51.0%
Grand Total	1.4%	32.2%	66.4%	100.0%

Figure 52: Invoice Value with Regularity.



The figure 36 is a further clarification of the scale of value under table 33 data.

Customer Survey.

The large customer base of 2667 in 2020 presents a huge challenge to pick a significant sample for a survey with the limited time available to complete this report in the midst of the Covid-19 epidemic. We used the following tabulation for selecting the sample. We decided on 25 interviews (customers) and to spend 15 minutes with each customer. This makes it a total of nearly 6 hours and 30 minutes. The high value customers were selected from those who had at least raised invoices to the value of Rs50,000 during the 2017-2020 years. The others were selected randomly with the exception of those in the high value selection.

Sampling Frame.

Predetermined size is 25 companies from the total list.

Figure 53: Basis of Selecting the Survey Sample

Customer Type	Customer Level	Sum of Total Invoice Value in Millions	Sum of Total Invoice Value %	Sample from a random selection	Sample from high value
Private	Large/Corporate	192.5	17.24%	3	2
	Micro Enterprises	55.6	4.98%	1	0
	SME	321.1	28.75%	4	3
Private Total		569.1	50.96%	8	5
Individual	Large/Corporate	238.8	21.39%	3	2
	Micro Enterprises	9.3	0.83%	1	0
	SME	28.3	2.53%	0	0
Individual Total		276.4	24.75%	4	2
Government	Large/Corporate	91.1	8.16%	1	1
	Micro Enterprises	4.9	0.44%	0	0
	SME	161.2	14.44%	2	1
Government Total		257.2	23.03%	3	2
NGO	Micro Enterprises	0.3	0.03%	0	0
	SME	8.5	0.76%	1	1
NGO Total		8.9	0.79%	1	1
Foreign	Micro Enterprises	0.7	0.06%	0	1
	SME	4.5	0.40%	1	0
Foreign Total		5.2	0.46%	1	1
Grand Total		1,116.7	100.00%	15	10

The following list of customers were selected as described here.

Customer Survey Sample.

Figure 54: Customer Survey Sample.

	Type	Level	Category	Value	Organization
				2017-2020	
High	Private	Large/Corporate	Regular	543,200	Ceyquartz MBI (Pvt) Ltd
	Private	Large/Corporate	Regular	476,795	BASF Lanka (Pvt) Ltd
	Private	Large/Corporate	Regular	862,458	Lanka Canneries Ltd
Random	Private	Large/Corporate	Regular	42,699	Randiya Natural Water (Pvt) Limited
	Private	Large/Corporate	Regular	705,745	Jafferjee Brothers
	Private	Large/Corporate	Regular	46,750	Built-Mech Services (Pvt) Ltd
	Private	Large/Corporate	Occasional	54,000	Naladanavi (Pvt) Ltd
Random	Private	Micro Enterprises	Occasional	66,950	Sinohydro (SL) Kaluganga Reservoir Headworks Project
	Private	Micro Enterprises	Regular	209,800	Global Surgical Products (Private) Limited
High	Private	SME	Occasional	84,298	Diamond Drop (Pvt) Ltd
	Private	SME	Regular	263,202	B R J W Enterprises (Pvt) Ltd
	Private	SME	Regular	113,100	BGN Industrial Tyre (Pvt) Ltd
	Private	SME	Regular	89,399	Unique Aromatics (Pvt) Ltd
	Private	SME	Regular	63,700	Natura Water System (Pvt) Ltd
Random	Private	SME	Regular	112,600	Barbara Sansoni Exports (Pvt) Ltd
	Private	SME	Occasional	31,000	Silk Route Trading (Pvt) Ltd
	Private	SME	Occasional	23,550	Maleena Distributors
	Private	SME	Regular	27,100	BND Consultants
	Private	SME	Regular	12,500	Jung Woo Lanka (Pvt) Ltd
High	Individual	Large/Corporate	Occasional	158,377	Mr. K P Somadasa
	Individual	Large/Corporate	Regular	353,685	Sunshine Tea (Pvt) Ltd
	Individual	Large/Corporate	Regular	385,090	Sinohydro Corporation Ltd
	Individual	Large/Corporate	Regular	369,049	Marshal Trading Company
Random	Individual	Large/Corporate	Regular	180,000	Health Guard Pharmacy Limited
	Individual	Large/Corporate	Regular	133,433	Lindel Industrial Laboratories Limited
	Individual	Large/Corporate	Regular	71,197	Water Mart Systems (Pvt) Ltd
Random	Individual	Micro Enterprises	Occasional	82,798	Tharana Star Botteling Drinking Water
	Individual	Micro Enterprises	Occasional	9,599	Mr R G Wimalasena
High	Government	Large/Corporate	Regular	2,913,841	Sri Lanka Tea Board
Random	Government	Large/Corporate	Regular	1,856,163	Ceylon Petroleum Corporation
High	Government	SME	Occasional	781,059	Metro Colombo Urban Development Project
Random	Government	SME	Occasional	367,481	Jaffna Municipal Council
	Government	SME	Occasional	113,697	District Secretariat - Anuradhapura
High	NGO	SME	Occasional	4193391.3	United Nations Industrial Development Organization
Random	NGO	SME	Occasional	1,171,200	People To People Volunteers
High	Foreign	Micro Enterprises	Occasional	286,253	Loesche Innovative Engineering
Random	Foreign	SME	Occasional	32,659	Euro Global Maldives Pvt Ltd
High	Foreign	SME	Occasional	348,965	Assured Environmental

We also prepared for the interviews by predetermining the questions for the interviews. The questions are given below. However, all these question are not relevant for all the companies and also one questions brings out answers for several questions.

Customer Survey Questions

Table 34: Questions for Customer Survey

Questions	Answers
Nature of the Business?	Food, FMCG, etc
Mode of delivery of samples to ITI?	Courier, Officer, Errands
What types of samples are given to ITI?	RA, Food, Water, etc. Further classify
Do you have formal Information when submitting your samples?	Filled up form, letter and form, letter only, none
How long does it take to handover your samples to ITI?	Below 5 mins, 5 to 30, 30 to 60, 60 – 120, Above
Are you producing for local or export markets?	Local, Export
Time taken to do the analysis at ITI in order to get the results (specified time)?	Within one hour, withing three hours, within six hours, within one day, two days, three days, four days, five days, one week, two weeks, three weeks, more
Charges levied by ITI when compared to other similar institutes?	Lesser, equal, higher
Whether ITI maintain the confidentiality of the results of your samples?	Yes, No, Responsible, Irresponsible, not concerned about confidentiality.
Whom do you contact directly after submission of the sample to get the status of the analysis?	Name and/or designation
For what purpose you use these samples?	Statutorily needed, buyers ask, export documentation, import clearance, market certification, health, safety, hygiene, ISO, SLS, Other Certifying body
If you have any plans to expand the business, how can ITI contribute?	Sample Testing, Product Development, Transfer Technology, Buying Technology,
Have you developed new products that need commercialization?	Have a protype, Trying to Commercialize, Patenting
How can ITI contribute to your product development?	Research, Prototype, Expertise, Market, Value Addition, Process Control, HR
Any other contribution/ suggestions that ITI can help you with?	Technology, Process, HR, Knowhow, Research, Development, Prototypes, Commercial Products, Training, Patents.
Any drawbacks/ weaknesses you observed?	Attitudes of ITI officers dealing with you?
How satisfied are you with ITI services?	Satisfied or not satisfied. Reasons

Quantitative Aspects of Customer Survey.

Out of the companies that participated in the survey there were producers or dealers of Tea, Water, Cement, Power, Handloom, Cinnamon, Oil, Construction, Silica, Detergents, Tyres , Fertilizer, AC, and Food.

These companies were producing for exports or catering to the local market while some companies were importers for local market.

Products and Trades of the Surveyed Companies.

The distribution of these companies among the different products and trade is as follows.

Table 35: Trade and Products of Interviewed Customers

TRADE	Product
EXPORTS	Cinnamon
	Food
	Handloom
	Silica
	Tea
	Tyres
IMPORTS	AC
	Oil
LOCAL MARKET	Cement
	Construction
	Detergents
	Fertilizer
	Power
	Water

.

The exporters have products that are quite valuable such as Cinnamon with a traditional reputation for Sri Lankan goodness as Ceylon Cinnamon (Cinamomum Zylanicum). The others who export food, handloom, silica, tea, and tyres have very important value to Sri Lanka. Tea particularly goes through various issues due to additives and attempts to export junk. As such ITI plays a key role in performing their quality checks with sample testing.

Imports too, have many pitfalls for the Sri Lankan consumer. The ITI has a responsibility to prevent harmful low quality imports through recognized testing methods.

The local market producers of cement, detergents, fertilizer, and water have various challenges on quality with specs while cement and power present environment challenges for the ITI to be vigilant.

Type of services needed by customers from the sample survey:.

Calibration of Equipment, Testing of Materials, Testing Food Quality, Testing Water Quality including Wastewater Testing, Environmental, Testing Noise Level, Test Vegetable Oil, Testing Engine Lubricants, Testing Air Quality, Residue Testing and Analysis, Testing Fuel Quality, Testing Soil, Testing Sludge, and Testing Sanitizer Quality.

Causes of Negative Perceptions.

Among the causes attributed by customers an outstanding cause for their dissatisfaction was the delay in receiving reports. The analysis shows that Report Delay was rampant at 43%. The next thorny issue was the Communication particularly getting information through the

general number given to customers. The reports are sometimes not giving the correct references to the original samples.

Table 36: Negative Perceptions of Interviewed Customers

Negative Perceptions	Percent Negatives
Report Delay	43%
Communication	13%
Traceability	9%
Awareness	9%
Report Quality	4%
Follow-Up Difficulty	4%
Site Visit Delay	4%
Online Services not Available	4%
International Standards Awareness	4%
Invoicing Delay	4%

There is an issue with the ITI awareness about the standards applicable to international markets and being able to advice customers appropriately. On some occasions the reports do not give full information as agreed with the customer. Sometimes the customers find it difficult to find out the progress with their reports. Scheduling site visits for calibration takes time and receiving reports by mail is another delay. On some occasions after receiving the invoice and having made the payment the report takes more time to receive.

Positive Comments by Customers.

On the positives customers commented quite well. Reports are received on Time, Pricing is Reasonable, were among the top comments. Then Results are Consistent, Results are Accurate, Reports are Preferred by Customers, No Returns of Exports after submitting ITI reports with consignments, ITI Service is Good, are some other points. There was a positive comment on service at the Reception on Sample Receiving as acceptable and Reception no Delay on Follow Up. Some positive comments on the reports reflected Reports Quality Good, Reports Within a Week, Reports are Authentic. A customer said Calibration Delay has been Reduced. Some said Confidentiality is OK, Reports are Recognized, Service is Satisfactory, and Reports are Satisfactory. ITI Training had benefited a customer to start business. One customer said Service Pricing is Less than India. Another one said Fully Satisfied. Several said Pricing is Similar to others. One customer mentioned ITI is the Best Institute. Another customer said the Technology Learned from ITI was useful. Reports High Accuracy was commended and Reports are Internationally Recognized.

So, all in all there are positives and negatives. While keeping the positives in mind as confidence building factor the purpose is to fix the negatives and go beyond the expectations of customers with service excellence.

Outcomes of the Customer Survey.

The outcomes of the survey are given below without reference to the company name. The purpose of this survey was to get a feel for the major barriers if any for the future development and not intended to find any faults or to go into detail analysis from a marketing point of view.

- Customer Satisfaction with the ITI Services.

We developed a perception of satisfaction with the services provided by the ITI to its customers.

- Weaknesses of the service value chain.

Communication channels.

Consistency of time taken for analysis.

Failure of the hot line or the front end to communicate accurately and convincingly.

- Quality and Reliability of service.

Above the rest of the service providers in Sri Lanka.

- Pricing of the services.

ITI is a reasonably priced provider among similar providers. Far less costly than the overseas providers of similar services particularly of the neighbouring India.

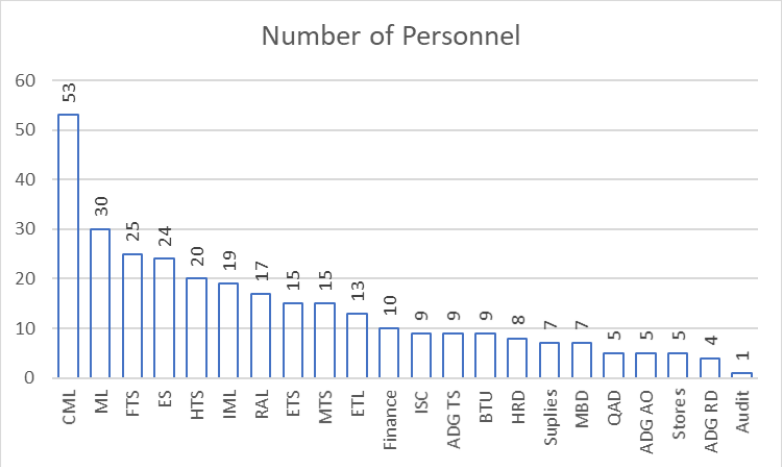
- Barriers to getting ITI to serve overseas.

The construction industry would like to take their equipment from Sri Lanka overseas but the exit process at the export gate is not adequately equipped to handle such requests.

Human Resources.

The highest number of personnel work in the CML, ML and FTS. The relative position can be seen easily from this chart.

Figure 55: HR Count in Descening Order of All



We have presented comparisons of the revenue and expenditure and in the following sections we will show the personnel strengths with that of revenue generation.

.

Categorization of Human Resources.

There are fourteen operational levels from the Director General down to the unskilled employees: AR-1, AR-2, HM 1-1, HM 1-3, HM 2-1, HM 2-2, HM 2-3, JM1-2, MA1-2, MA2-2, MM1-1, PL 1, PL 2, and PL 3.

There are twenty-one categories of employees in the ITI as follows.

Academic / Research AR-1, Assistant Research Technologist MA2-2, Boiler Operator MA2-2, Computer System Assistant MA2-2, Draughtsman MA2-2, Glass Blower MA2-2, Junior Manager JM1-2, Library Assistant/Information Assistant MA2-2, Manager MM1-1, Master Craftsman MA2-2, Non-Technological MA1-2, Primary Level – Semi skilled PL 2, Primary Level – Skilled PL 3, Primary Level – Unskilled PL 1, Senior Academic & Research AR-2, Senior Manager – Academic & Research HM 1-3, Senior Manager HM 1-1, Senior Manager HM 1-3, Senior Manager HM 2-1, Senior Manager HM 2-2, and Senior Manager HM 2-3.

These categories are distributed among seventy three designated jobs as follows. AC & Refrigeration Mechanic, Accountant, Accounts Officer, Additional Director General (Administration & Operation), Additional Director General (Research & Development), Additional Director General (Technical Services), Administrative Officer, Assistant Engineer (Electrical/Premises/Maintenance), Assistant Librarian, Assistant Research Technologist, Boiler Operator, Carpenter, Chief Accountant, Chief Engineer, Chief Internal Auditor, Chief Research Technologist, Computer System Administrator, Computer System Assistant, Computer Systems Engineer, Confidential Secretary, Customer Liaison Officer, Director – Finance, Director (Administration & Human Resources Development), Director (Marketing & Business Development), Director General, Draughtsman, Driver, Electrician, Engineer (Premises/Electrical/Maintenance), Glass Blower, Helper, Human Resource Officer, Industrial Liaison Officer, Institute Secretary, Internal Auditor, Internal Auditor Officer, Laboratory

Attendant, Librarian, Library Assistant/Information Assistant, Library Attendant, Machinist, Management Assistant, Marketing Officer, Master Craftsman, Motor Mechanic, Plumber, Principal Computer System Engineer, Principal Quality Assurance Officer, Principal Research Scientist/Engineer, Quality Assurance Officer, Research Engineer, Research Fellow/Research Professor, Research Scientist, Research Technologist, Senior Computer System Engineer, Senior Quality Assurance Officer, Senior Administrative Officer (HR), Senior Administrative Officer (Admin), Senior Computer System Administrator, Senior Customer Liaison Officer, Senior Industrial Liaison Officer, Senior Lab Attendant, Senior Legal Officer, Senior Marketing Officer, Senior Research Engineer, Senior Research Scientist, Senior Research Technologist, Senior Stores Officer, Senior Supplies Officer, Stores Officer, Supplies Officer, Tinker, Welder/Fitter, and Workshop Attendant.

The complete picture of the Level, Category and Job Titles are as follows.

Table 37: Level Category and Job Title at the ITI

Level	Category	Job Title
HM 2-3	Senior Manager HM 2-3	Director General
HM 2-2	Senior Manager HM 2-2	Additional Director General (Administration & Operation)
		Additional Director General (Research & Development)
		Additional Director General (Technical Services)
HM 2-1	Senior Manager HM 2-1	Research Fellow/Research Professor
HM 1-3	Senior Manager – Academic & Research HM 1-3	Chief Engineer
		Principal Computer System Engineer
		Principal Quality Assurance Officer
		Principal Research Scientist/Engineer
	Senior Manager HM 1-3	Chief Internal Auditor
		Director – Finance
		Director (Administration & Human Resources Development)
		Director (Marketing & Business Development)
		Institute Secretary
HM 1-1	Senior Manager HM 1-1	Chief Accountant
		Chief Research Technologist
AR-2	Senior Academic & Research AR-2	Senior Computer System Engineer
		Senior Quality Assurance Officer
		Senior Research Engineer
		Senior Research Scientist
AR-1	Academic / Research AR-1	Computer Systems Engineer
		Quality Assurance Officer
		Research Engineer
		Research Scientist
MM1-1	Manager MM1-1	Accountant

		Confidential Secretary
		Engineer (Premises/Electrical/Maintenance)
		Internal Auditor
		Librarian
		Senior Administrative Officer (HR)
		Senior Administrative Officer (Admin)
		Senior Computer System Administrator
		Senior Customer Liaison Officer
		Senior Industrial Liaison Officer
		Senior Legal Officer
		Senior Marketing Officer
		Senior Research Technologist
		Senior Stores Officer
		Senior Supplies Officer
JM1-2	Junior Manager JM1-2	Accounts Officer
		Administrative Officer
		Assistant Engineer (Electrical/Premises/Maintenance)
		Assistant Librarian
		Computer System Administrator
		Customer Liaison Officer
		Human Resource Officer
		Industrial Liaison Officer
		Internal Auditor Officer
		Marketing Officer
		Research Technologist
		Stores Officer
		Supplies Officer
MA2-2	Assistant Research Technologist MA2-2	Assistant Research Technologist
	Boiler Operator MA2-2	Boiler Operator
	Computer System Assistant MA2-2	Computer System Assistant
	Draughtsman MA2-2	Draughtsman
	Glass Blower MA2-2	Glass Blower
	Library Assistant/Information Assistant MA2-2	Library Assistant/Information Assistant
	Master Craftsman MA2-2	Master Craftsman
MA1-2	Non-Technological MA1-2	Management Assistant
PL 3	Primary Level – Skilled PL 3	AC & Refrigeration Mechanic
		Carpenter
		Driver
		Electrician
		Machinist
		Motor Mechanic
		Plumber

		Senior Lab Attendant
		Tinker
		Welder/Fitter
PL 2	Primary Level – Semiskilled PL 2	Laboratory Attendant
		Library Attendant
		Workshop Attendant
PL 1	Primary Level – Unskilled PL 1	Helper

The population of employees in each of the offices is indicated below. The highest numbers are 53 engaged with CML 53, ML 30, FTS 25, ES 24, and HTS 20.

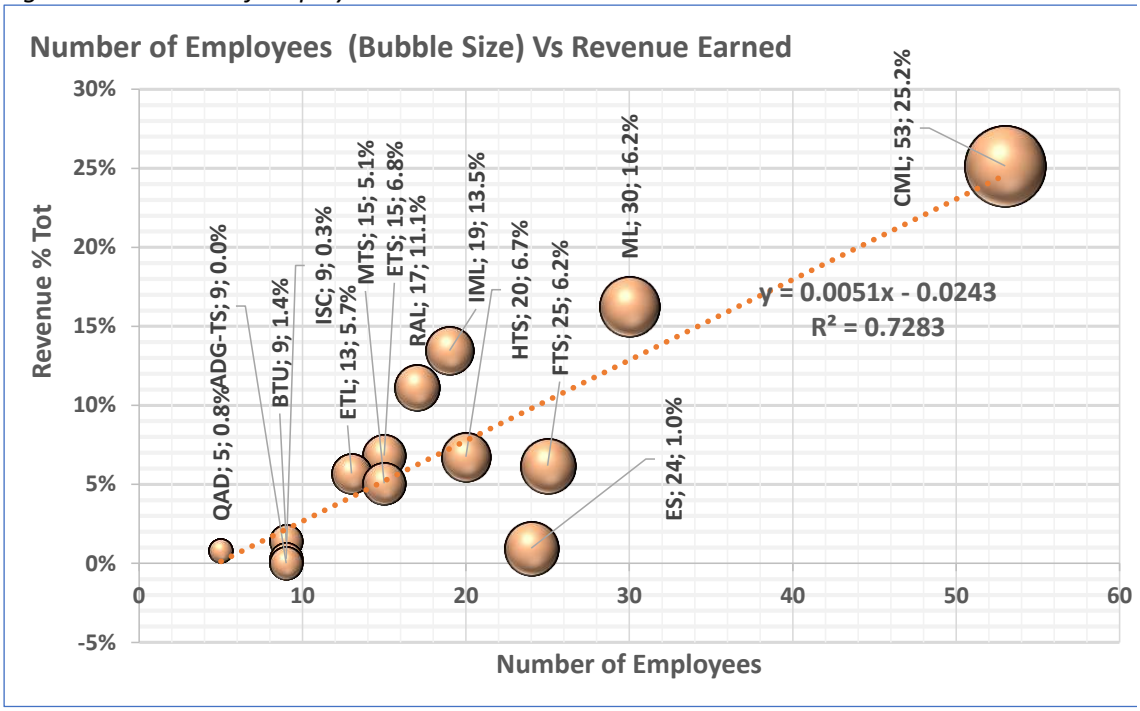
Table 38: Populations in Laboratories and Other Places

Row Labels	Count of Names
CML - Chemical and Microbiology Lab	53
ML- Materials Laboratory	30
FTS- Food Technology Section	25
ES - Engineering Services	24
HTS- Herbal Technology Section	20
IML - Industrial Metrology Lab	19
RAL- Residue Analysis Laboratory	17
ETS- Environment Technology Section	15
MTS- Materials Technology Section	15
ETL - Electrotechnology Laboratory	13
Transport Unit	11
Finance, Section	10
MP&LTL- New Lab Lubricant testing	10
ISC - Information Service Center	9
BTU- Biotechnology Section	9
ADG-TEC Serv Office	9
HRD Human Resources Department	8
MBD- Marketing and Business Department	7
Supplies Department	7
MPTL- New Lab Lubricant testing	6
Director General's Office	6
Computer Unit	6
QAD- Quality Assurance Department	5
Stores	5
ADG - A&O Office	5
ADG - R&D Office	4
Chairman's Office	2
Internal Audit Section	1
Grand Total	351

Revenue and Personnel.

The following figures are presented to highlight the magnitude and the variability of different factors of production and the impact of those factors in the outcomes.

Figure 56: Number of Employees Vs Revenue %.



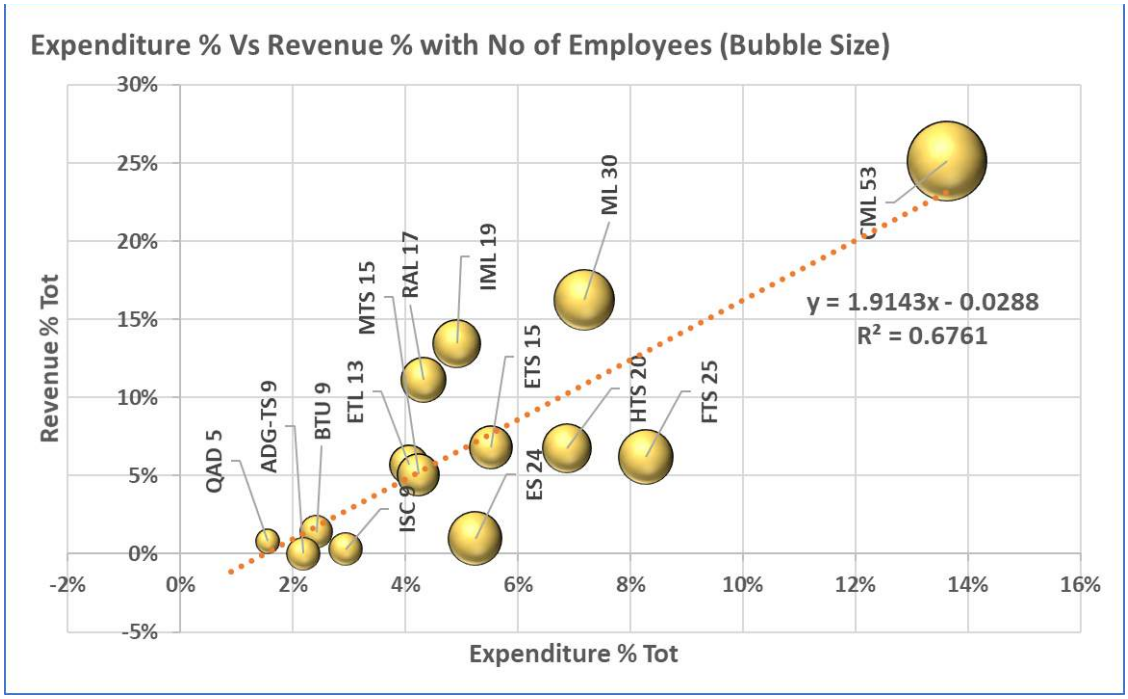
The figure shows the progression of the number of employees in revenue earning sections highlighted by the number of employees from the bubble size. CML has 53 employees with a revenue of 25.2% of total revenue earned during the review period. Likewise, QAD has 5 employees with 0.8% earned. Looking up the employee line, say ~20, one can figure out the revenue earned from HTS, IML have 6.7% and 13.5% revenue. Looking across ~5% revenue level ETL, ETS, MTS, HTS, and FTS have employees 13, 15, 15, 20, and 25. There is variance in their marginal productivity. It is a subject of discussion for the management to determine the sources of these institutional outcome variances. If these are significant then they should be investigated with research. The general linear regression is a good fit to understand the marginal revenue value per employee which is about 0.51%.

Expenditure Vs Revenue with Employees

The figure below shows the variation of Revenue with Expenditure with the bubble size showing the number of employees which is an important chart. It shows that revenue increases with expenditure and with the numbers of people working in the subdivisions in general. In closer examination questions arise as to how some sections perform better while having the same expenditure with similar numbers of personnel. The revenue earned in reality cannot be satisfied as it does not cover the overheads as shown in previous analyses. As such the marginal revenue increase for each percent increase in expenditure should be much higher than what has been achieved. The linear regression shows the relationship

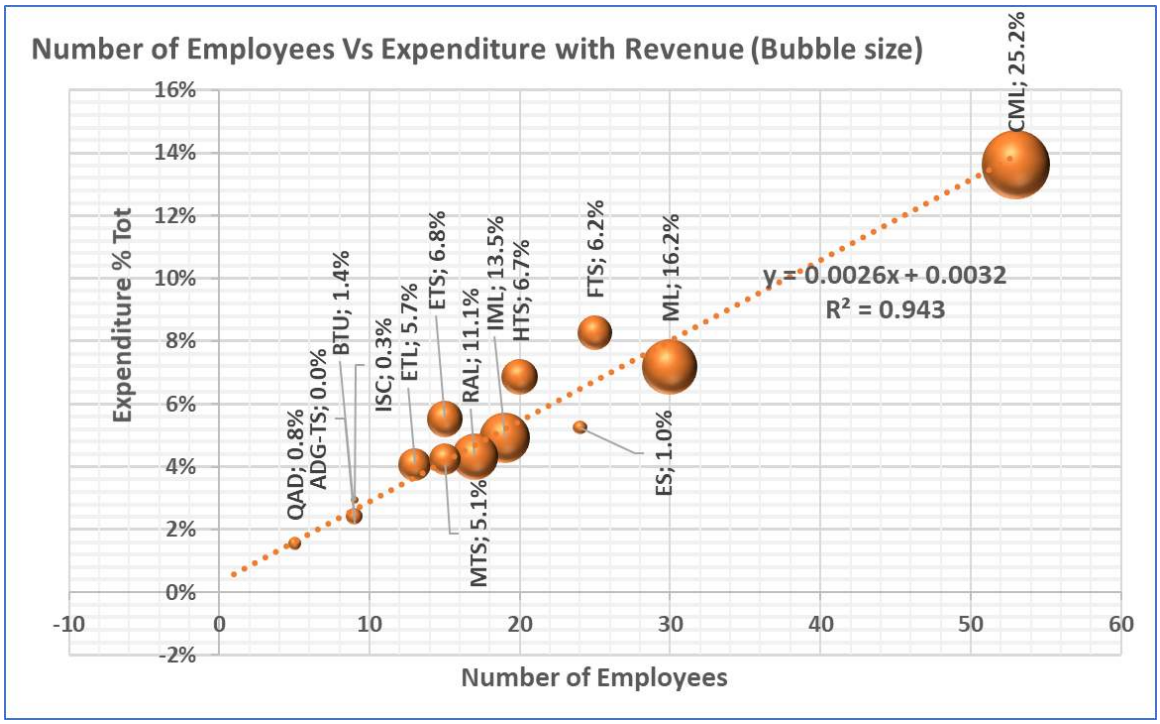
between revenue and expenditure. For each percent increase in expenditure there is a gain of 1.9143% in revenue at present.

Figure 57: Expenditure Required to Generate Revenue with Employees



Number of Employee Vs Expenditure % with Revenue %

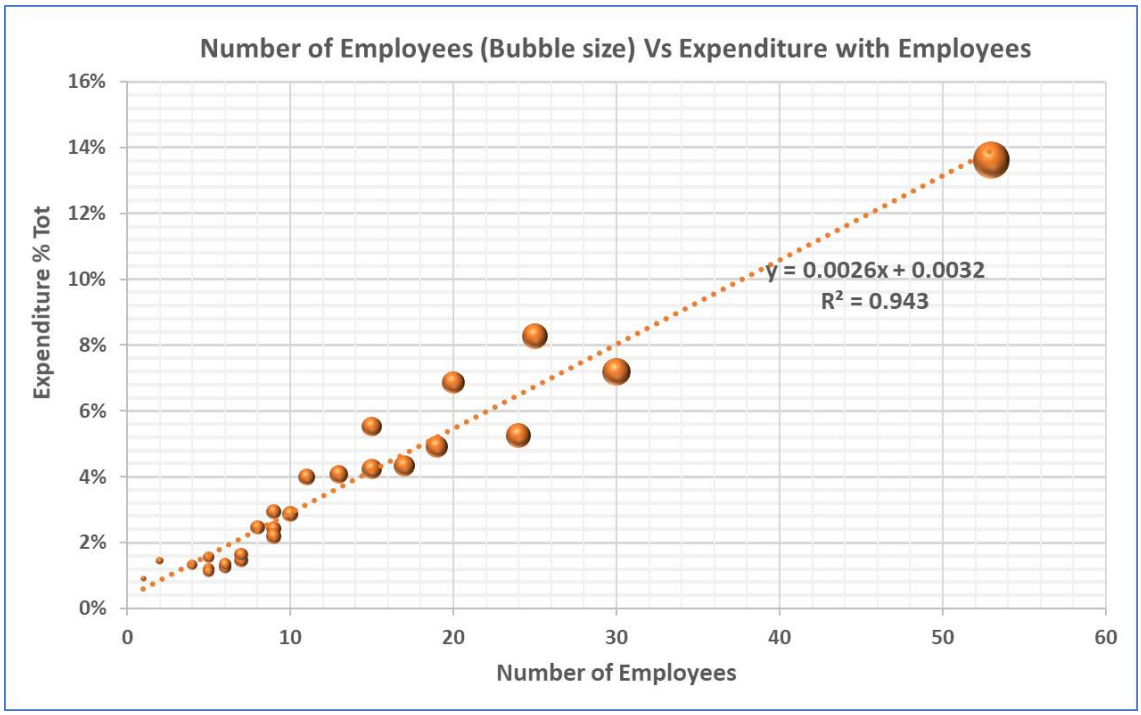
Figure 58: Number of Employee Vs Expenditure % with Revenue (bubble size)



This figure gives a clear picture of the rising expenditure with the numbers of employees. There is a tight correlation of 94.3% while the marginal increase in expenditure for each employee is 0.26%. The labels show the subdivision and the revenue %. It enables the identification of the more productive subdivisions which are RAL, IML and ML.

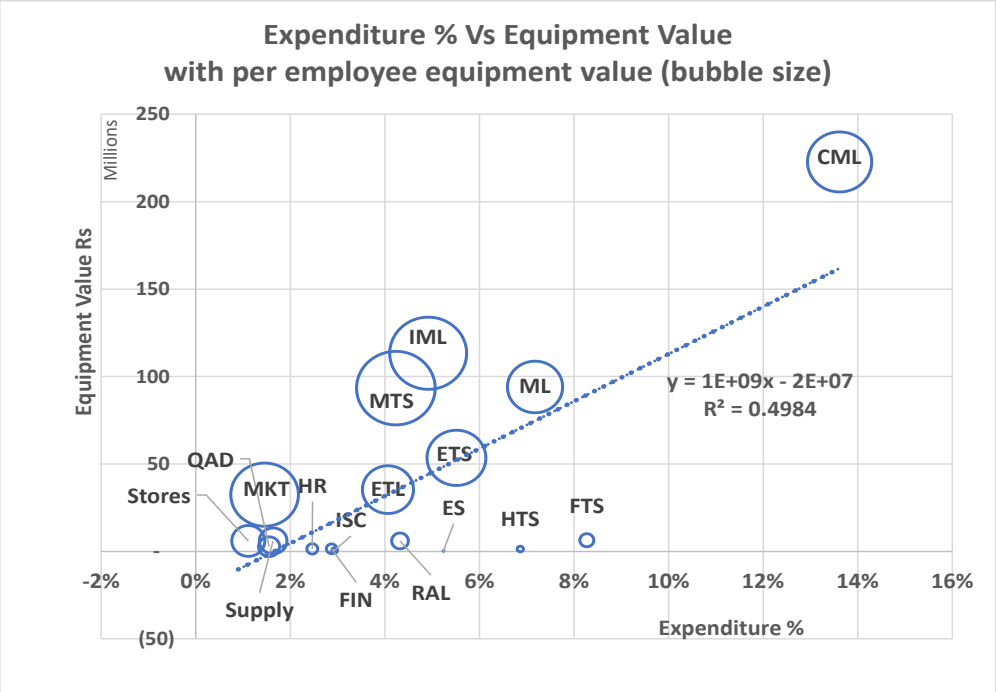
Complementary to these charts the next chart shows pure total expenditure % with the numbers of employees. This chart includes all subdivisions except something identified in the expenditure as General but has no numbers of personnel involved.

Figure 59: Number of Employees Vs Expenditure %



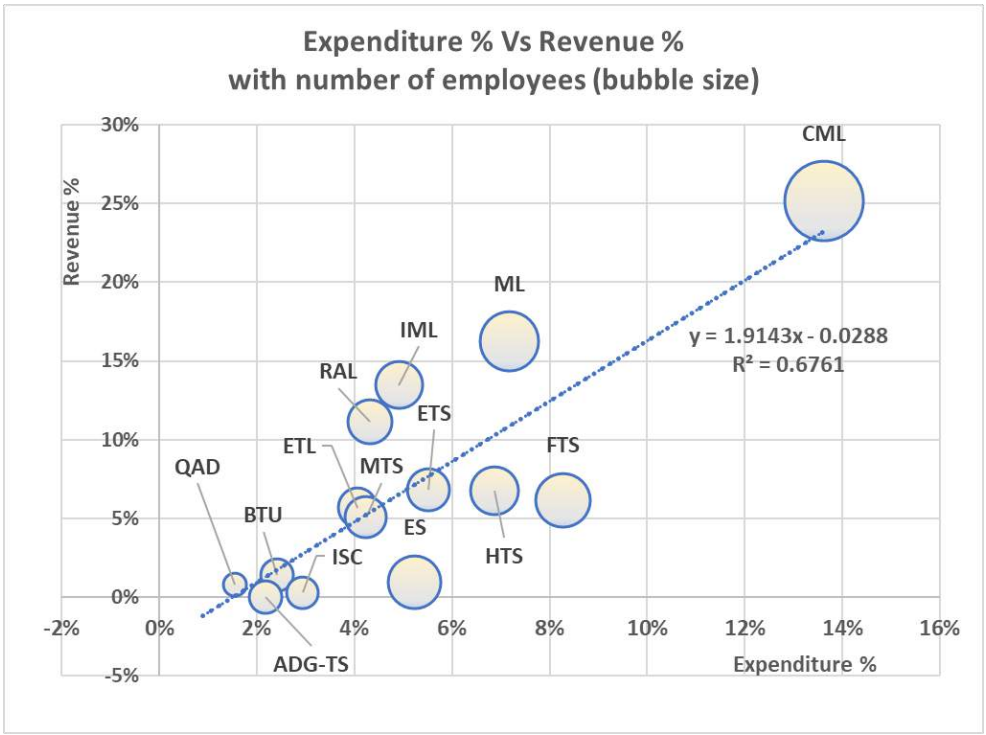
Equipment Value with Expenditure and Personnel

Figure 60: Equipment Value Vs Expenditure with Equipment Value per Employees



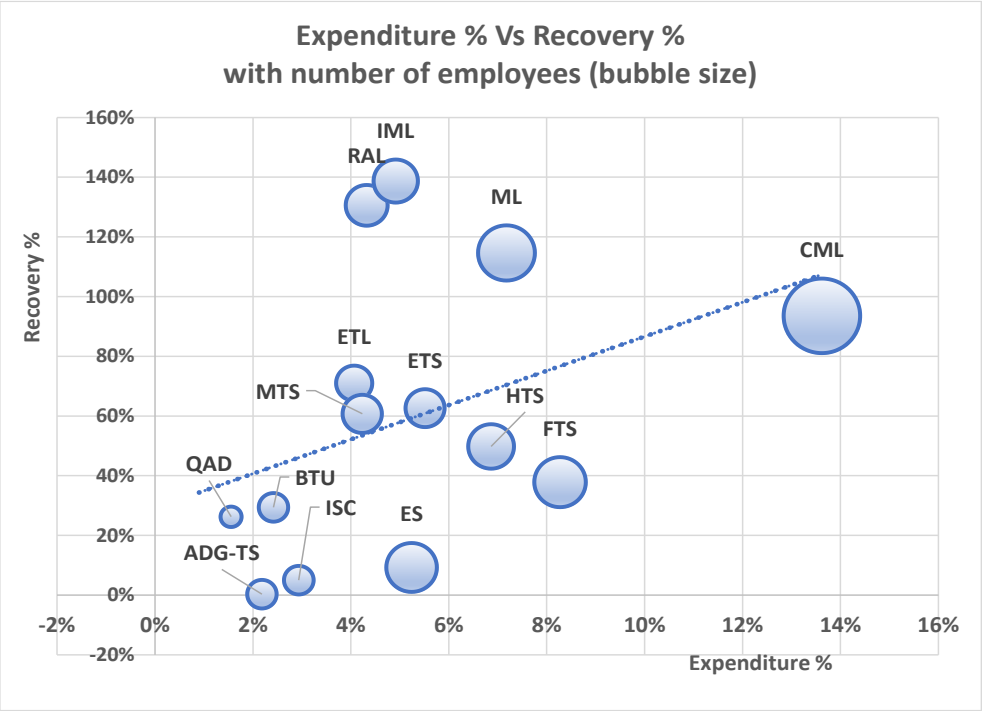
The equipment value and expenditure have no real correlation. The equipment value per employee shown by the bubble size brings more information into the picture. The chart shows that even though the value of equipment per employee is low there is high expenditure in some subdivisions.

Figure 61: Expenditure Vs Revenue with Employees.



The above figure shows the Expenditure Vs Revenue with the numbers of personnel. There is some correlation between the two variables and it also goes to show the relative numbers of personnel in these subdivisions.

Figure 62: Expenditure Vs Recovery with Employees

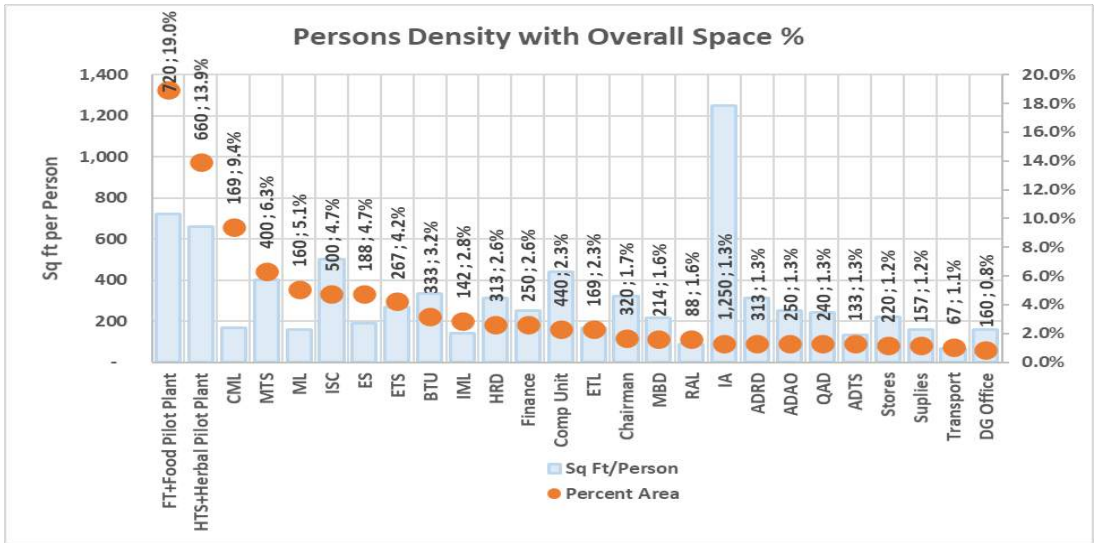


The figure above shows that at around the same level of expenditure there could be different recovery levels. In fact, RAL and IML have surpluses while ES, ETS, ETL, and MTS have different levels of recovery. These are facts that should be explored.

Personnel Density at the ITI

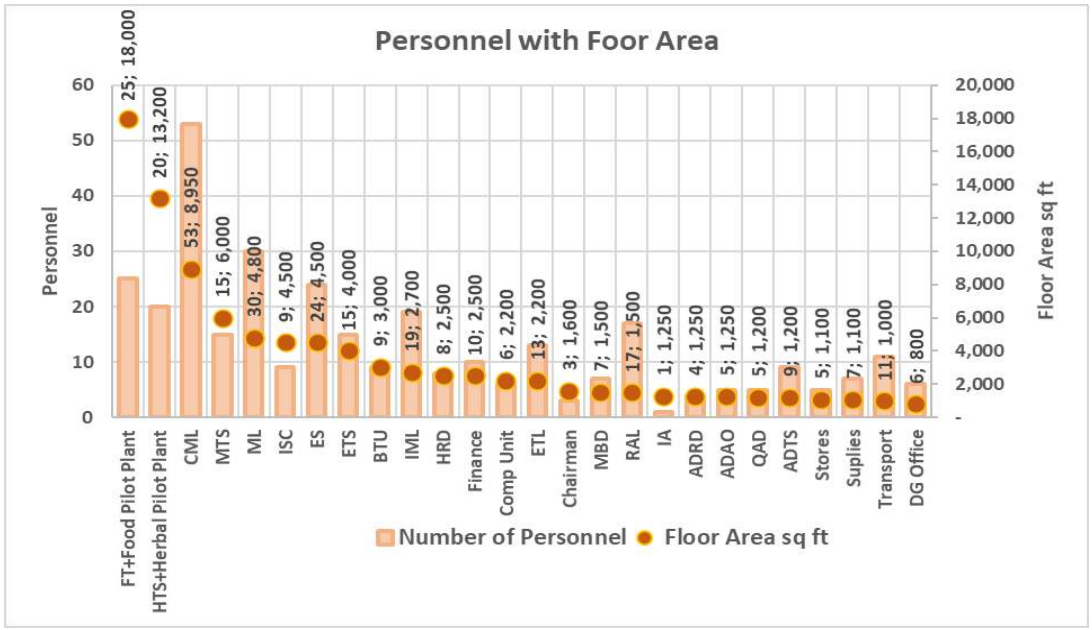
The different sections at the ITI occupy space reserved for their personnel working at the three locations. We have taken density of people working in those locations and plotted with the space occupied per person. The figure below shows the two variables with a decreasing

Figure 63: Personnel Density at ITI



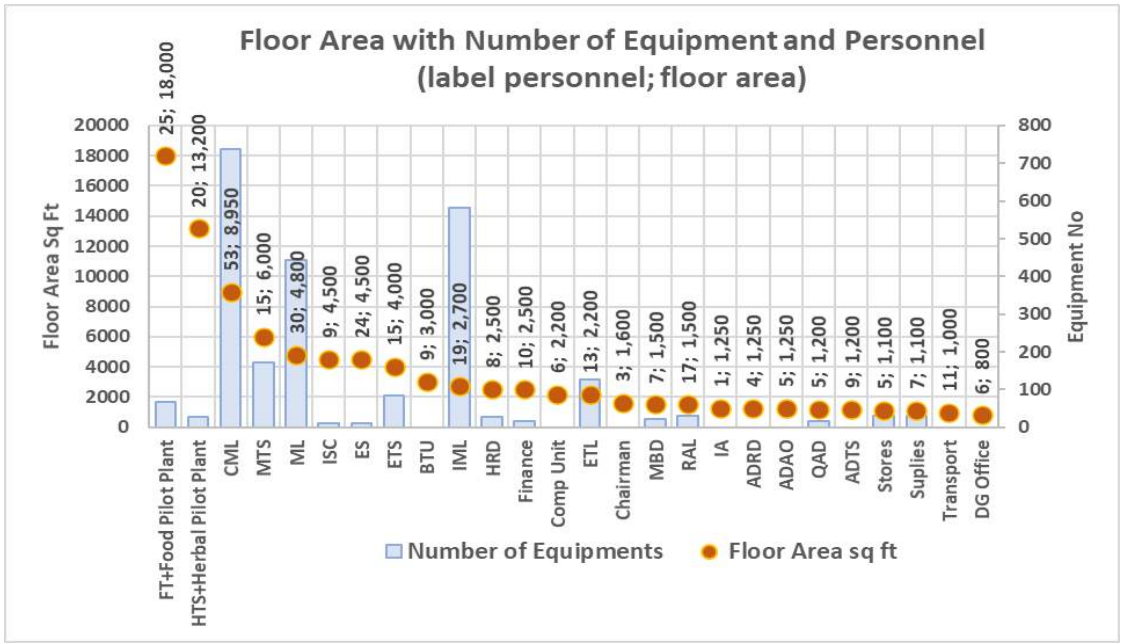
sequence of the percent area. Currently underdeveloped FT +Food Pilot Plant and TEC Serv +Herbal Pilot Plant have both measures at the highest level and sequence can be examined on the x axis.

Figure 64: Floor Area and the Number of Persons



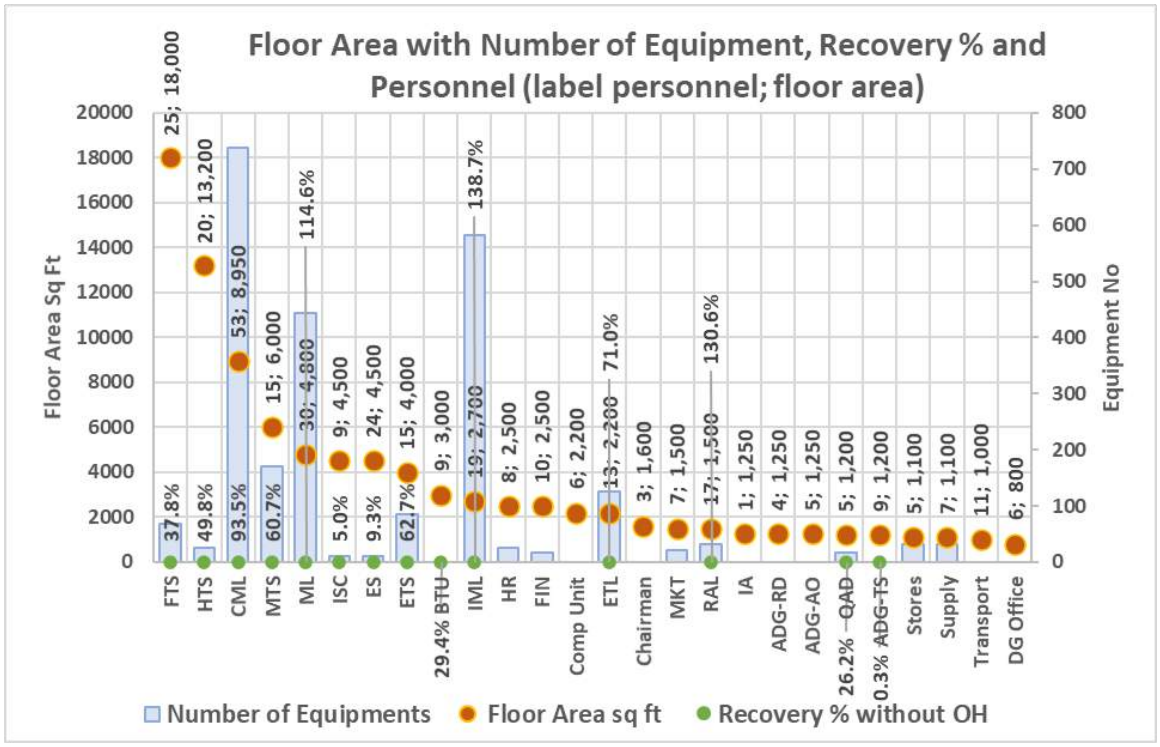
The above chart shows the number of personnel with the floor area of the sections. As expected the two pilot plants have the highest measures in area.

Figure 65: Floor Areawith Number of Equipment and Persons



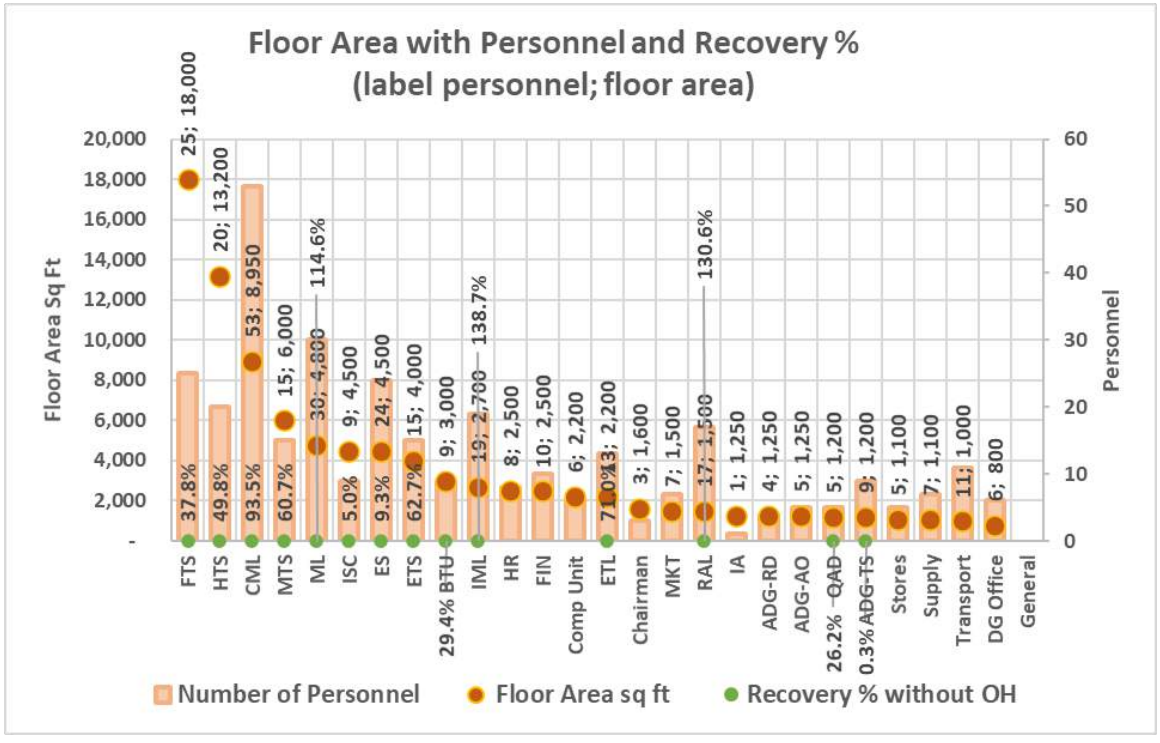
The above figure shows the floor area with the number of equipment stationed in those areas. It also gives the number of personnel in the area indicated in the label. Currently the two pilot plants have very few equipment with a large floor area and relatively less people.

Figure 66: Floor Area with Number of Equipment, Recovery% and Persons



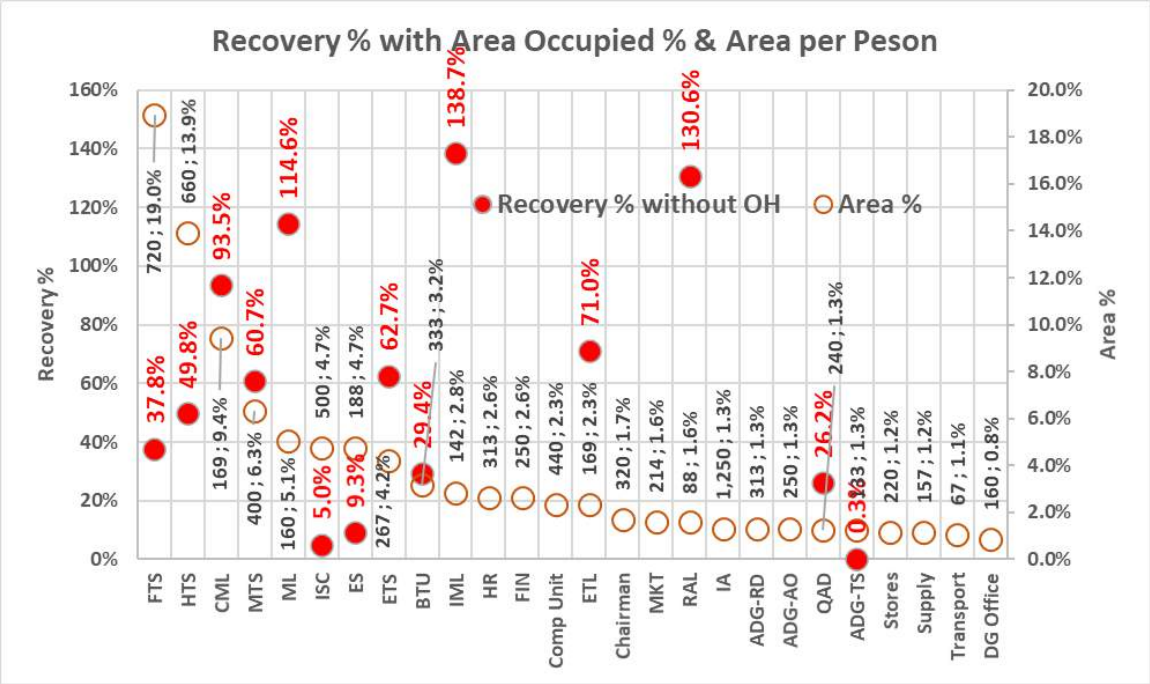
The above figure brings in an additional factor into the picture. The recovery level is indicated. Floor areas and the numbers of equipment show any reasonable correlation with the recovery level.

Figure 67: Floor Area with Persons, and Recovery%



The above image gives the floor area with the number of personnel in areas and the recovery level. It is sorted by the decreasing order of floor area. Once again the recovery level shows no correlation to these factors at the ITI operational level.

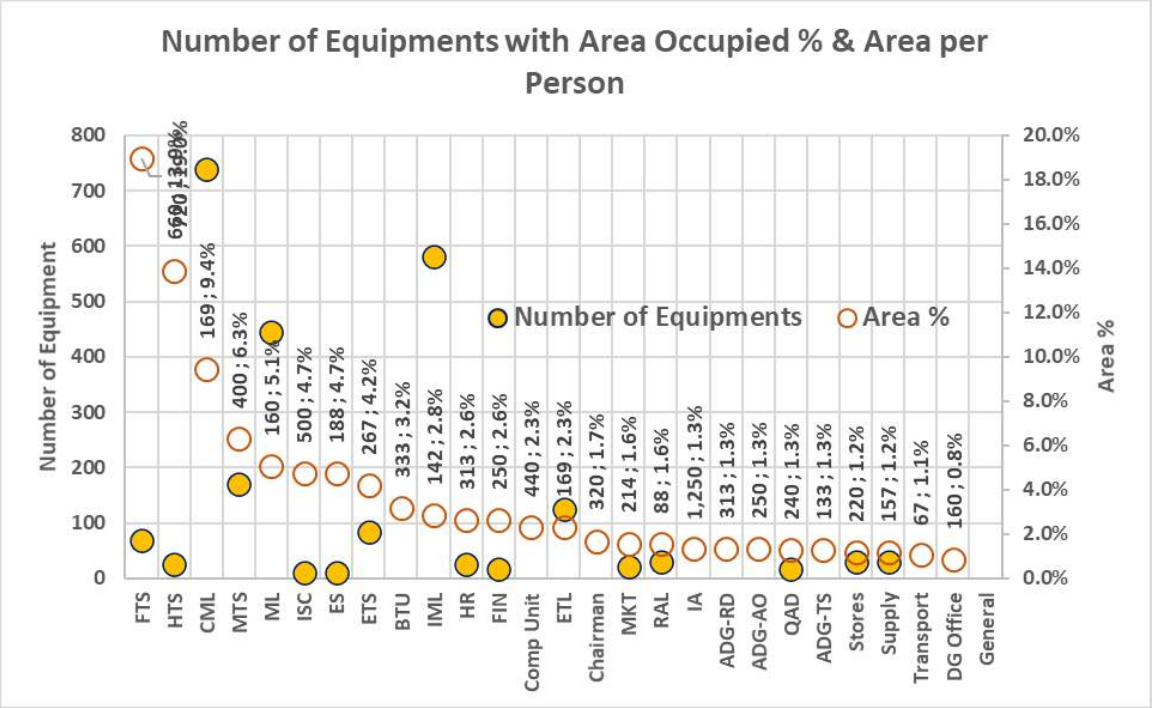
Figure 68: Recovery % with Area Occupied % and Area per Person



The above figure plots the recovery level with the area % of the section and shown in a decreasing order of the area occupied. RAL, IML and ML have surpluses while the others are shown with their levels.

This figure also carries information about those areas that do not generate revenue.

Figure 69: Number of Equipment with Area Occupied% and Area per Person



The above figure is a representation of the amount of equipment with the percent area occupied added with the area per person with the marker of the area label.

Analysis of Variables at ITI to Generate Revenue

Table 39: The Causes and Impacts Summary

Section	Recovery % without OH	Revenue % Tot	Expenditure % Tot	Number of Personnel	Number of Equipments	Approx Value of Equipment	Floor Area sq ft	Area %	Sq Ft/Person
IML	139%	13.5%	4.9%	19	582	113,319,653	2,700	2.8%	142
RAL	131%	11.1%	4.3%	17	31	5,992,889	1,500	1.6%	88
ML	115%	16.2%	7.2%	30	444	94,063,876	4,800	5.1%	160
CML	94%	25.2%	13.6%	53	738	222,720,629	8,950	9.4%	169
ETL	71%	5.7%	4.1%	13	125	35,330,938	2,200	2.3%	169
ETS	63%	6.8%	5.5%	15	85	53,497,471	4,000	4.2%	267
MTS	61%	5.1%	4.2%	15	171	93,372,572	6,000	6.3%	400
HTS	50%	6.7%	6.9%	20	26	1,397,929	13,200	13.9%	660
FTS	38%	6.2%	8.3%	25	68	6,407,933	18,000	19.0%	720
BTU	29%	1.4%	2.4%	9			3,000	3.2%	333
QAD	26%	0.8%	1.6%	5	17	2,673,059	1,200	1.3%	240
ES	9%	1.0%	5.2%	24	10	246,419	4,500	4.7%	188
ISC	5%	0.3%	2.9%	9	10	586,200	4,500	4.7%	500
ADG-TS	0%	0.0%	2.2%	9			1,200	1.3%	133

Above table is about the relative position of all measurables illustrated in the above charts connected to recoveries only. These sections represent the revenue generating sections of the ITI.

A regression analysis gave the following results for an equation to determine the Revenue % from the Total revenue generated at the ITI. This can be applied in the subdivisions divisions or even the entire ITI. It will apply only to the revenue generating areas.

Figure 70: Equation to Calculate Revenue % of Total Revenue

$$Y = a + \sum_{i=1}^{5} a_i X_i$$

Where

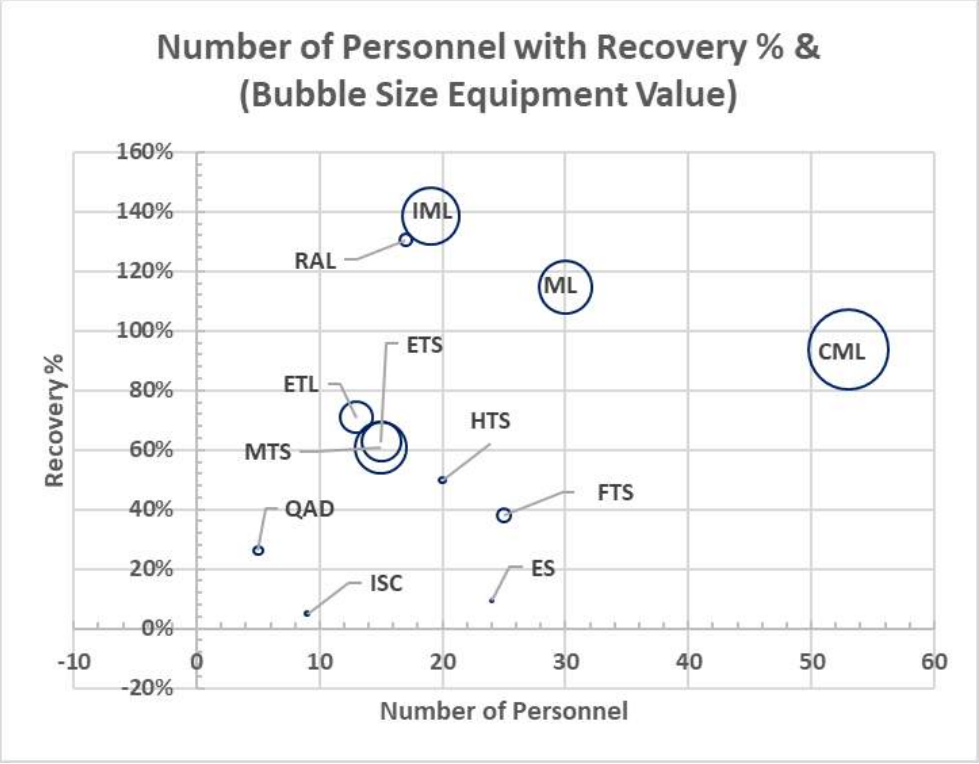
a	-0.02353414	*Y*	Revenue %
a1	2.447426779	*X1*	Expenditure % Tot
a2	-0.00314167	*X2*	Number of Personnel
a3	0.000223939	*X3*	Number of Equipments
a4	-1.2027E-10	*X4*	Approx Value of Equipment
a5	-2.4756E-06	*X5*	Floor Area sq ft

Regression Statistics	
Multiple R	0.985305
R Square	0.970826
Adjusted R Square	0.922204
Standard Error	0.022207
Observations	9

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	0.049232	0.009846	19.96652	0.016476705
Residual	3	0.001479	0.000493		

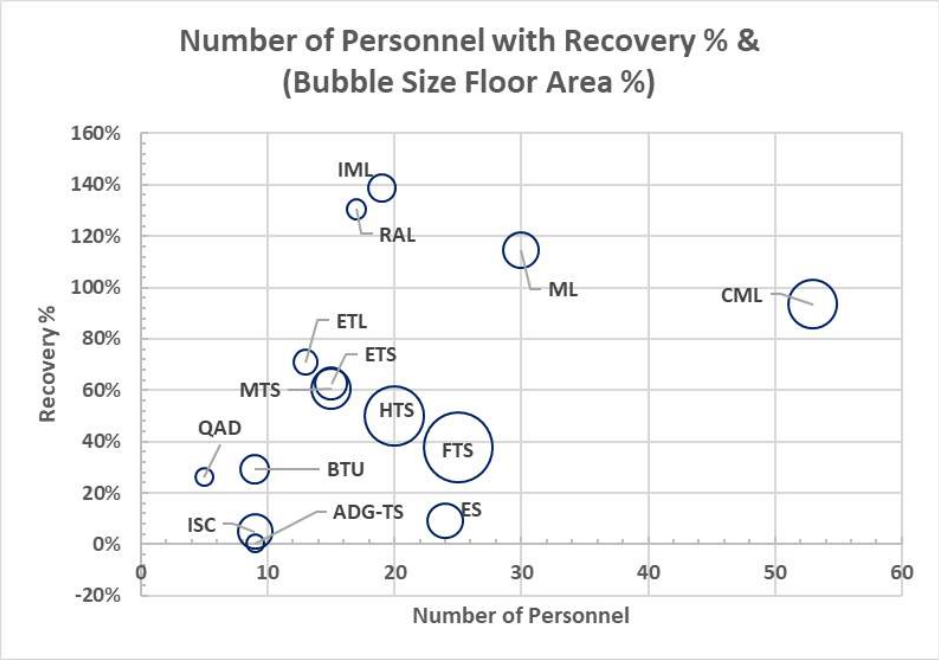
Figure 71: Personnel with Recovery % (Bubble Size Equipment Value)



This figure shows the equipment value in bubble size with recovery and number of personnel. It does not show a higher recovery with higher personnel numbers or equipment value.

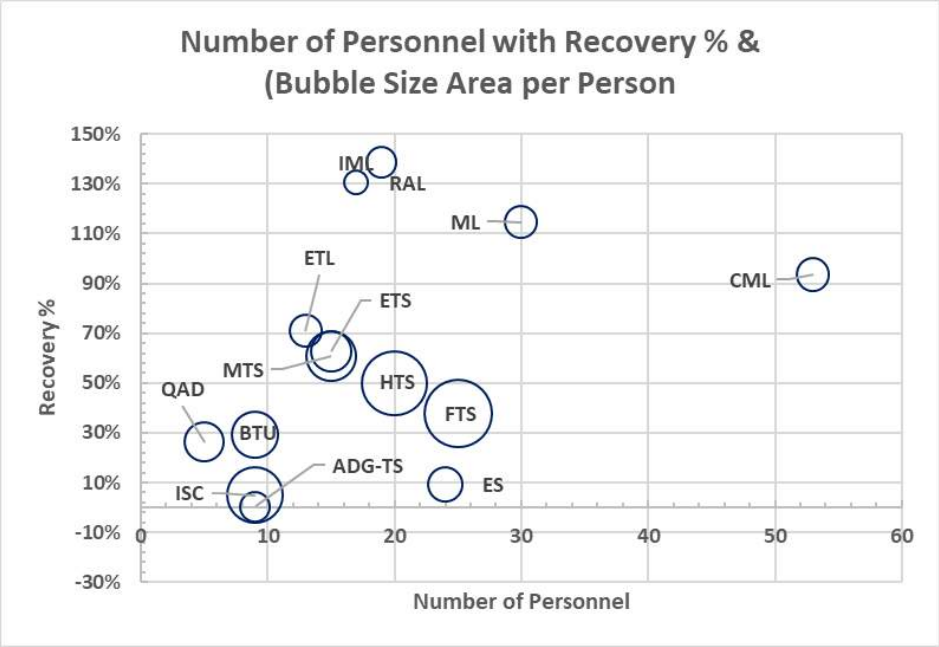
However, it points to the fact that subdivisions can be highly productive in spite of low value of equipment.

Figure 72: Recovery % with Personnel (Bubble Size Floor Area%)



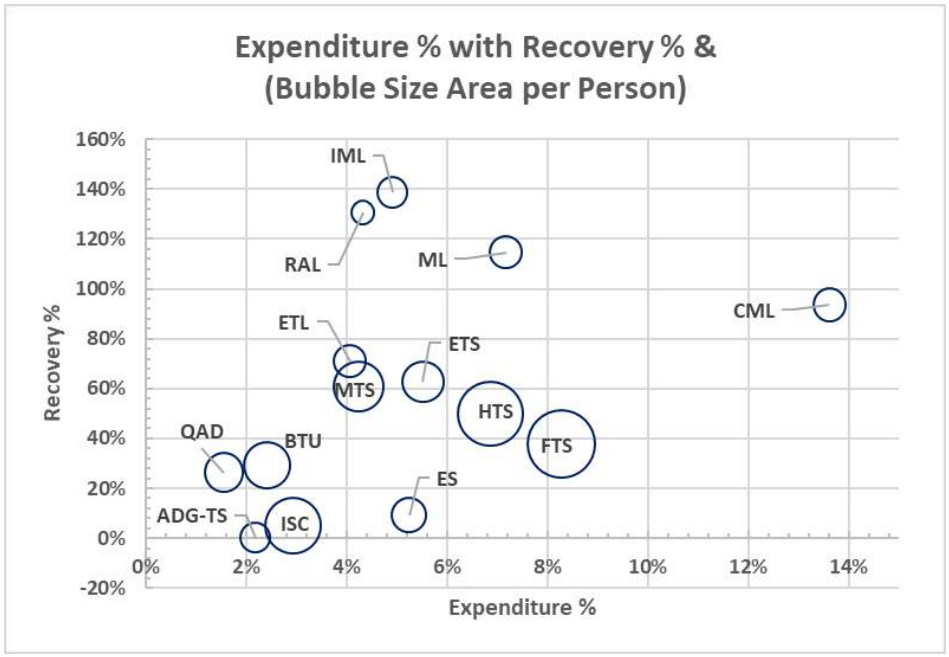
Bubble size shows the floor area. There is a tendency to increase recovery with the number of personnel.

Figure 73: Number of Personnel with Recovery % (Bubble Size Area per Person)



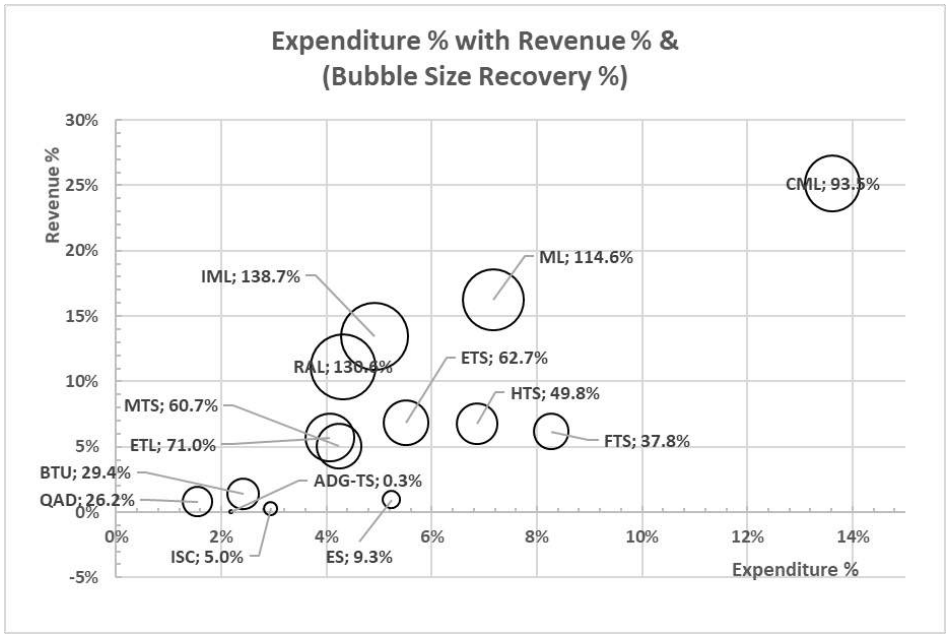
The above figure shows the recovery level with the number of personnel imposed with the area per person by the bubble size. Disregarding FT and HTS as they are still in a state of development it shows that more area per person does not necessarily guarantee an increased recovery rate.

Figure 74: Expenditure % with Recovery % (Bubble Size Area per Person)



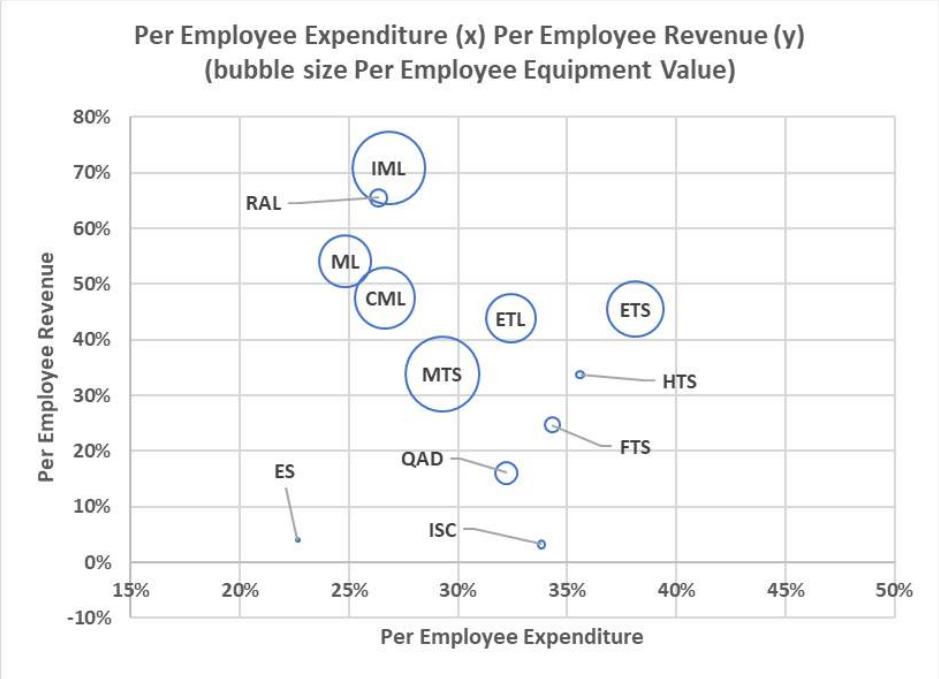
RAL and IML have recovered fully with relatively less areas per person but not so with other sections. Some sections with low expenditure and low recovery have high areas per person that could be made use of to improve productivity.

Figure 75: Revenue % with Expenditure % (Bubble Size Recovery %)



The above figure shows the expenditure and revenue with the recovery rate (as bubble size). Expenditure and revenue have a correlation and shows the recovery rate also clearly superimposed as added value to information.

Figure 76: Per Employee Expenditure with Per Employee Revenue (Y) (Bubble Size Per Employee Equipment Value)



The above chart gives the situation per employee showing the expenditure and revenue both per employee super imposed with per employee equipment value. It illustrates that the expenditure per employee has no correlation with revenue per employee.

Opportunities Presented in VPS.

In dealing with VPS the ITI has plenty of room to get into lucrative business and expand their horizons. The divisions which are lacking in strength to undertake these suggestions could develop their business plans based on achievable goals in the short term by recruiting the right technologists. This requires a restructured organization and using facilities at Malabe and developing Malabe further.

Table 40: Vistas of Prosperity and Splendour - Opportunities for ITI

Suggestions to include in the ITI Review Report for VPS Opportunities		
Sub- Sector	Strategies (and other)	Activities for ITI
Agriculture	Agriculture development through advanced technological innovations.	Crop science production processing, packaging, distribution are involved
		Outreach with Agriculture Department. Introduce traditional rice varieties as they are nutritional values have been tested by ITI
	Building up a healthy and productive nation guaranteeing the people's right for safe food.	Develop food safety standards keeping international standards ahead. Proactively seek sample testing from the food market and action through relevant authorities.
	International export business through various value added products backed up by new technologies	R&D on value addition to national food products. Giving priority for indigenous food varieties, prepare food additives using local spices, oleoresins and essential oils
	Production of Seeds and Planting Materials.	The biotechnology section to undertake production of seeds and planting material. Biotechnology research to upgrade local food varieties to uplift the nutritional value (not only tomato)
	A standards certificate will be made compulsory to import seeds	Develop local standards keeping with international standards.
	Promote private sector to produce quality planting material on a large scale.	Collaborate with private sector on developing quality planting material.
Packaging and Storage	Create necessary facilities to store surplus production	Develop new technology for storage and packaging. (Low cost processes)
	Introduce an internationally accepted organic product certification system	Develop organic product standards and a certification system
	Sri Lanka Standards Institute will be improved to securing necessary certification.	Outsource ITI services to SLSI.

	Introduce a programme of action combining the state and private sector institutions to minimize wastage of products in harvesting, transport, and delivery.	ITI should continue to develop postharvest technology with greater applicability. (Low cost packing systems)
	Introduce new railway coaches and improve railway infrastructure to expand the role of the railways in goods transport.	ITI can extend their applications to railway transport from road transport.
Research for Agricultural Innovation	Provide assistance to develop innovative bio-pesticides and low cost integrated pest management system.	The testing of pesticides and connected work should be used to develop biopesticides and integrated systems in consultation with the Agriculture Department. Specially for control of paddy bug and red weevil in coconut plantations
	Establish a patent system so that the researchers could patent their innovations.	Patenting experience has to be expanded to include the priority with the institute and shared with the researchers at the ITI
	Expand and promote agricultural education by providing technological facilities to agricultural colleges.	Agricultural colleges could learn much from ITI.
	Facilitate domestic institutions involved in agricultural research to collaborate with international research bodies.	ITI already has international connections and this experience could be shared with others and also learn from others with better experience.
Export Crops	Establish an internationally accepted product quality inspection system and a system of geographical information certificates.	Already Tea and several other products benefit from ITI. The system is internationally accepted. Those which are not accepted should gain acceptance. Need to implement Geographical Indicator (GI) Registration for branding our Ceylon commodities.
Tea	Introduce methods to maintain and improve the quality of Sri Lankan tea.	All the quality standards involved in tea cultivation, processing, packaging and marketing should be explicitly laid down for the benefit of tea industry. GI studies and branding. Sensory evaluations
	Promote our tea in international markets as pure Ceylon Tea.	The GI coupled with Ceylon Tea brand will have a differentiating impact on tea.
Rubber	Introduce new rubber varieties capable of yielding at shorter time	Rubber research from a material point should be extended to composite rubber materials.

	Encourage researchers, scientists, and producers to undertake the research in value addition and technological innovations.	A system of proactive participation in seeking good innovations for further development and value addition and then also to share benefits should emerge from ITI.
Coconut	Develop Bio technical solutions to control the various pests	This area should be newly introduced at the ITI.
	Introduce machines for plucking coconuts and expand their usage.	ITI should strengthen engineering works with more research on mechanical, electrical, mechatronics, etc,.
	Provide facilities to Coconut Research Institute and private laboratories to develop high yielding plants.	The CRI work should be complemented in biotechnological solutions for high yielding varieties.
	Distribute high yielding hybrid coconut varieties among people to expand coconut growing in home gardens.	As above.
Other Export Crops	Prompt action to ban the import and re-export of minor export crops.	The standards of local varieties should be well established in order to facilitate this.
Cinnamon	Develop new technological methods for extraction and packaging of cinnamon. Imports of such high technology equipment will be made free of import tariff.	The cinnamon research at ITI should be strengthened to produce value added cinnamon from the basic raw material now exported. Make use of the opportunity to strengthen the laboratories. Implement GI registration. Sensory evaluation of Ceylon cinnamon. Check adulteration of Ceylon cinnamon
	Establish a technical training course at a suitable NVQ level	Work with TVEC to achieve this.
	Establish cinnamon extraction and preparation centre for the use of owners of plantations of less than five acres.	Work with the relevant Ministry/Department to develop this facility on PPP basis
	Initiate assistance schemes to support cinnamon related value added industries.	Start work on this proactively as there is much R&D knowledge at ITI
Pepper	Establish a programme to provide technical support to pepper producers.	Establish standards for pepper varieties and different forms and train pepper cluster players. Introduce efficient extraction methods for piperine content in pepper
Turmeric		Identify areas in Sri Lanka where turmeric produces best harvests. Establish efficient low cost method to extract curcumene

Fisheries	Introduction of scientific methods to increase fish population in coastal areas.	ITI has R&D on processing of fish. This has to be vertically taken up to achieve this.
	Develop refrigeration systems using sea water for multiday fishing craft and encourage the use of solar power.	This requires solar research combined with water. ITI should develop multidisciplinary work on this.
	Develop facilities to construct and maintain large multiday fishing craft in Trincomalee.	The engineering section at ITI should strengthen to get into marine vehicles.
	Build-up of all fishery harbors, anchorages and landing sites with modern communication facilities, refrigeration, fuel supply and sanitation facilities.	ITI should explore the multitude of opportunities presented here.
	Expand production of canned fish by providing facilities to private companies and entrepreneurs	The food safety and processing technology knowhow available at ITI should be extended
	Develop a programme to involve women in fishery related household industry	The training programs at ITI should be extended to this community of fisher folk.
	Commence a programme jointly with the fisheries community associations and the National Aquaculture Development Authority for the expanded breeding of both sea and freshwater fish.	The backward integration suggested earlier should apply here.
	Implement a programme of technical and managerial training in fishery activities for the youth using the Ocean University.	ITI knowledge should be made available through structured training on credits.
	Develop systems of pricing of fish products so that both producer and consumer achieve a fair deal.	ITI should assist in this work as relative COPs of different products are known to ITI and it makes this task more scientific. Remember that the prices move on supply and demand in the market situation.
Milk Production	Undertake research to select and introduce varieties of cattle to suit different geographical regions.	This involves backward integration to ground level in the milk industry.
	Introduce a “vertical cattle shed system” to maintain a larger number of cattle on smaller areas.	ITI engineering with the milk technology knowhow can participate.
	Establish a new milk pricing system based on milk quality.	Milk quality standards are available to ITI and the pricing is an extension.

	Introduce high quality grass through National Livestock Development Board	The forage and biotechnology at ITI should participate in this wok.
	Introduce small-scale solar-powered refrigeration facilities to increase the milk storage facilities	The solar energy section should undertake.
Meat and Eggs for Export	Introduce international standards and effective monitoring systems to animal farms and production facilities.	This is a vast area where ITI should gather information relevant to Sri Lanka and disseminate. The standards for Sri Lanka should be developed at the ITI.
	Encourage value addition	All research at the ITI are aiming for value addition.
Business / Enterprise Development	Restrict export of currently identified natural resources (mineral sands, dolomite, phosphate, and gems) in raw form	The ITI should strengthen research on value addition to mineral resources.
	Develop programmes to get higher prices for those through value addition before export.	As mentioned earlier. ITI also should embark on training customers to embrace value addition
	Commence investigations for discovery of resources, believed available in the earth and in the seabed will be undertaken using high-tech methods	ITI should develop both areas of earth resources and oceanic resources. The latter offers a huge potential.
	Provide facilities to large-scale businesses to commence production of various high technology products	ITI is in a good position to extend services through proper CRM to work in collaboration on these high tech areas.
	Protect, safeguard, and strengthen domestic entrepreneurs on special focus	The ITI should reach out to such entrepreneurs with special service packages.
	Restrict entry of foreign enterprises into industrial areas that are easily handled by domestic businesses	ITI has a major role to detect the imported products, their quality and to keep the government authorities informed.
Tourism	Identify new attractions of the country for foreign tourists	ITI can attract foreign PhD, MPhil students on research for high level work in collaboration with other universities. This educational tourism.
Small and Medium Industries	SMI with Value addition	ITI plays a significant role to help develop SMIs. The role should go beyond simple testing to innovations and development.
	Ease the scarcity of raw material	The ITI should be in a position to play an advisory role to find substitutes and good raw materials from local resources.

	Provide necessary encouragements for the purpose to undertake value added activities	As mentioned earlier on value addition
Technology and Innovations	Establishing a Technology Based Society (Smart Nation)	ITI is empowered by an act of a to undertake this activity.
	Establish Sri Lanka as a Global Innovation Hub	ITI should go out to fetch innovators and develop their products and skills to high commercial level to support this aim.
	Maximize the use of innovative measures in Internet of Things (IoT), Artificial Intelligence (AI), Biotechnology, Robotics, Augmented Reality, Cloud Computing, Nanotechnology, and 3D printing.	ITI should use its vast resources to train and spread the knowhow and provide practical experiences to citizens.
	Set up a Citizen Centric Digital Government for the convenience of citizens	ITI should first digitize its system integration and then help with other government efforts.
	Establish an e-procurement system to eliminate bribery & corruption	ITI should set up e-procurement first and extend help to others.
Establish Digitally Inclusive Sri Lanka	Establish a country wide high speed optical data transmission system and a high speed 5G Mobile Broadband System to facilitate data transmission	ITI should monitor the implementat1ion of 5G for its impact for TRC.
	Introduce a mobile & digital payment system to handle all financial transactions	ITI should strengthen the technology knowhow on digital systems including e-payments.
Ensuring water for all	Make awareness campaign to educate people with the support of university students, school children and youngsters about keeping water resources clean.	This is an area for ITI to use its wealth of water related experience and training facilities.
	Encourage application of modern techniques and drip irrigation into the agriculture for the efficient water usage.	The drip irrigation systems and other recycling and conservation mechanisms could be developed by ITI.
	Protect rivers, lakes and reservoirs/tanks from chemicals, pesticides, and other harmful chemicals.	The ITI should be on the constant lookout for pollution and it should be having a routine system for checks while responding rapidly on emergency calls.
	Introduce a water storage mechanism for all new houses located in water-scarce areas to recharge the ground water and reduce ground water misuse.	ITI should undertake this work.

	Expand and improve the efficiency of current projects implemented by National Water Supply & Drainage Board and Community Water Supply Projects.	ITI is doing sample testing on this project. However, ITI should expand their services beyond testing to actually on advisory work.

.

Scientific Research Publications etc.

The following analysis may be considered as one of ITI's KPI achievements. The outcomes projected under some key performance indicators have no measurable indicators forecast in a strategic plan that we could find. These numbers are actuals and whether the performances indicated by these numbers are reasonable in considering the resources available to the ITI is subject to the review team judgement.

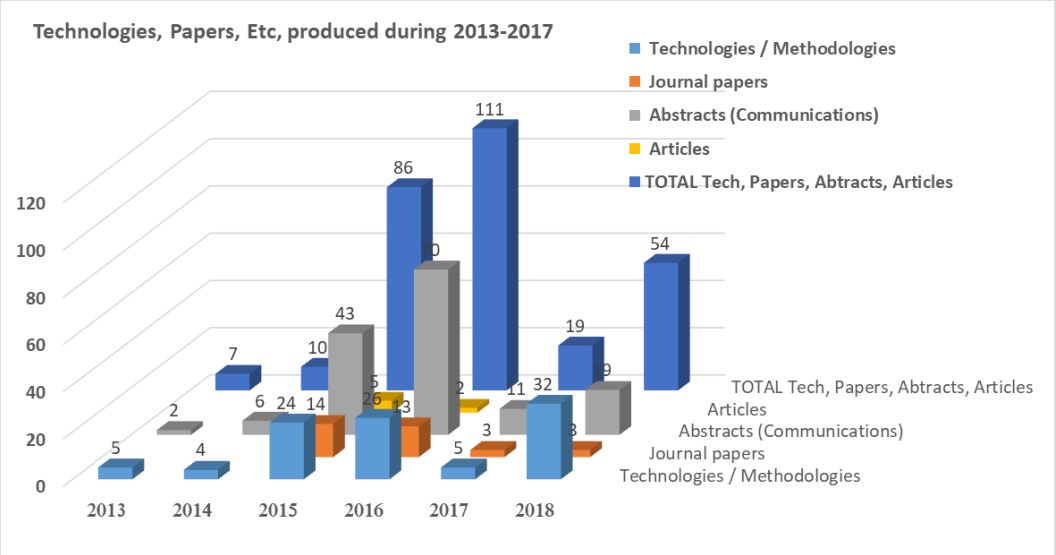
The ITI's record of completed Technologies, Methodologies, Journal Papers, Abstracts and Articles shows the following picture. More abstracts have been communicated and papers and articles have been much less. The Technologies and Methodologies developed at the ITI during the six years is 96. There has been a high of activity during 2015 and 2016 which was subdued in 2017 and 2018. There have been no Articles during 2017 and 2018.

Table 41: Technologies, Publications, etc,. during 2013 to 2018

Start Year	End Year	Technologies / Methodologies	Journal papers	Abstracts (Communications)	Articles	NCBI GEN Bank submissions	Publications	Book Chapters
2013	2018	5		2			7	
2014	2017	4		6			10	
2015	2017	6	5	3	2	20	37	
	2018	5	9	12	3	15	40	2
	2019	13		28		13	54	1
2016	2017	4		5		3	12	
	2018	9	5	23			35	1
	2019	12	4	33	2	16	72	
	2020	1	4	9			10	
2017	2018	1		2			3	
	2020	4	3	9		46	59	
2018	2019	9		3			12	
	2020	15	2	6			21	
	2021	8	1	10			18	
Total		96	33	151	7	113	390	4

The figure below shows the pattern over the six years 2013 to 2017.

Figure 77: Technologies, Publications, etc,. 2013 - 2018.



The time lapse between the start and end of each of these works was studied and shown.

The table shows the spread of time taken by the activities/projects handled by the ITI. It is shown as a frequency distribution between 8 and 67 months within 10 month ranges. The most frequent occurrence is between 28 to 37 months at 40%. The time of completion has 58% cumulative occurrences below 37 months while above that has a 42%.

Figure 78: Sum of Technologies, Publications, etc., start and end between 2013 to 2021

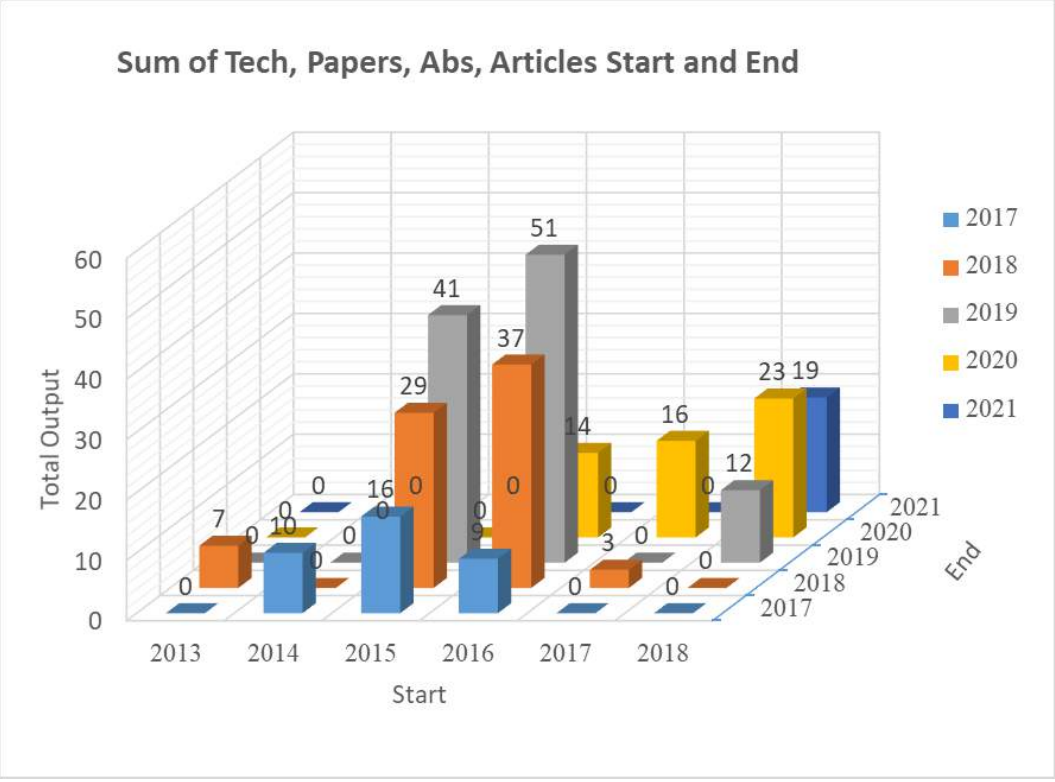


Table 42: Sum of Technologies, Papers, etc., Started and Ended during 2013 to 2020						
Sum of Tech, Papers, Abs, Articles Start Year and End Year						
	End Year					
Start Year	2017	2018	2019	2020	2021	Grand Total
2013	0	7	0	0	0	7
2014	10	0	0	0	0	10
2015	16	29	41	0	0	86
2016	9	37	51	14	0	111
2017	0	3	0	16	0	19
2018	0	0	12	23	19	54
Grand Total	35	76	104	53	19	287

We have analyzed the duration in number of months taken to complete other works and the following picture has emerged.

.

.

.

Table 43: Months taken by Technologies to complete		
Months Taken	Months Taken by Technologies / Methodologies	Technologies / Methodologies % in Category
8-17	8	8%
18-27	20	21%
28-37	42	44%
38-47	7	7%
48-57	10	10%
58-67	9	9%
Total	96	100%

Table 44: Months Taken for Completion of ITI Activities

Months Taken for Completion	NCBI GEN Bank submissions	Awards/ Recognition	Patents Granted	Technology Transfers	Book Chapters	Popularisation activities/ workshops	Major Outputs	Method Validations	Methods transferred Inside	ITI Booklet
8-17							2			
18-27	23	6	1	1		2		4		
28-37	46	3	6	3	1					1
38-47	31	14	3	2	2	5		6	2	
48-57	13				1	2	2			
58-67										
Total	**113**	**23**	**10**	**6**	**4**	**9**	**4**	**10**	**2**	**1**

There are no occurrences taking more than 57 months.

Figure 79: Months Taken for Completion of Work Funded by Grants

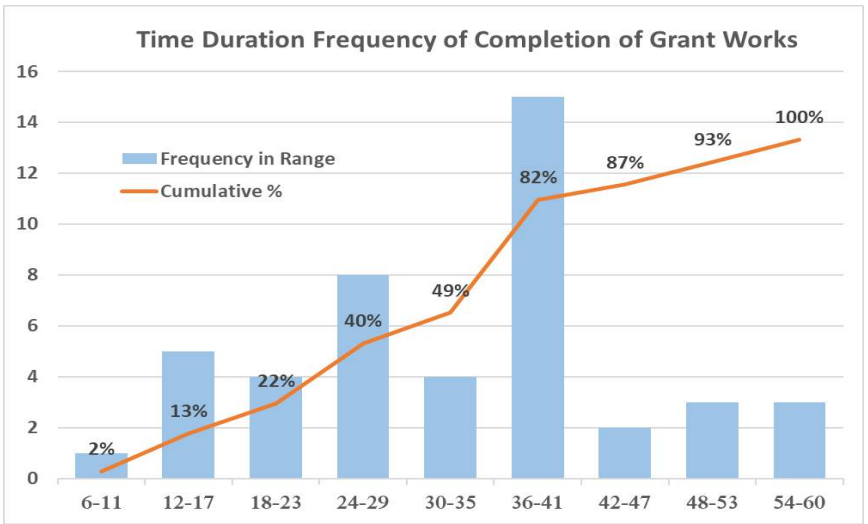
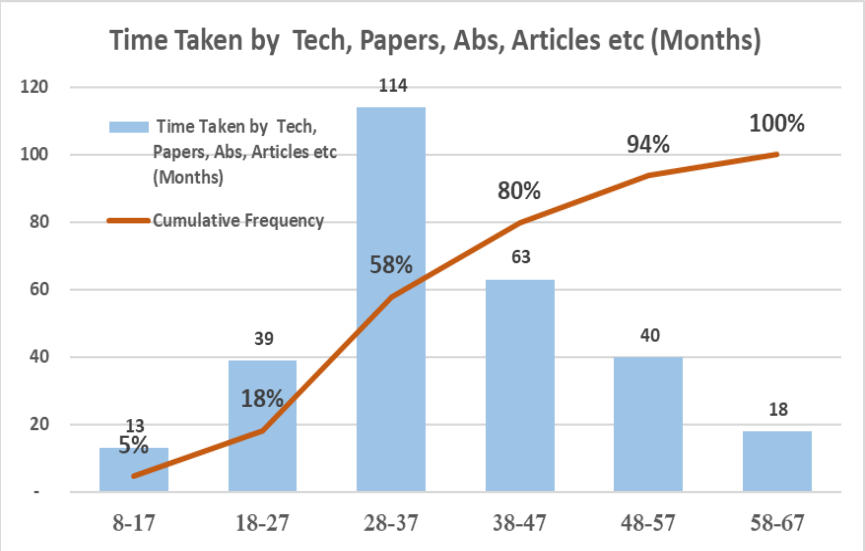


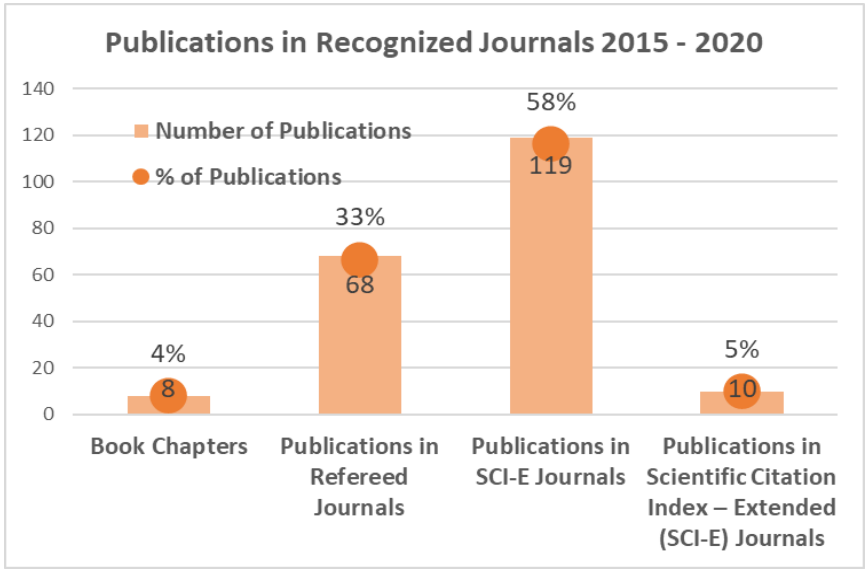
Figure 80: Months Taken for Completion of Tech, Papers, Abs, Articles, Etc.



Publications in Scientific Journals.

During the five years period of 2015 to 2020, the Scientists at the ITI have published 205 times in Journals and Books. The numbers read Publications in SCI-E Journals as 119 (58%) and Publications in Refereed Journals count 68 (33%.). Publications in Scientific Citation Index – Extended (SCI-E) Journals is 10 (5%). There have been 8 Book Chapters (4%).

Figure 81: Publications in Recognized Journals 2015 - 2020



The distribution of publications during the years in journals and books are presented below.

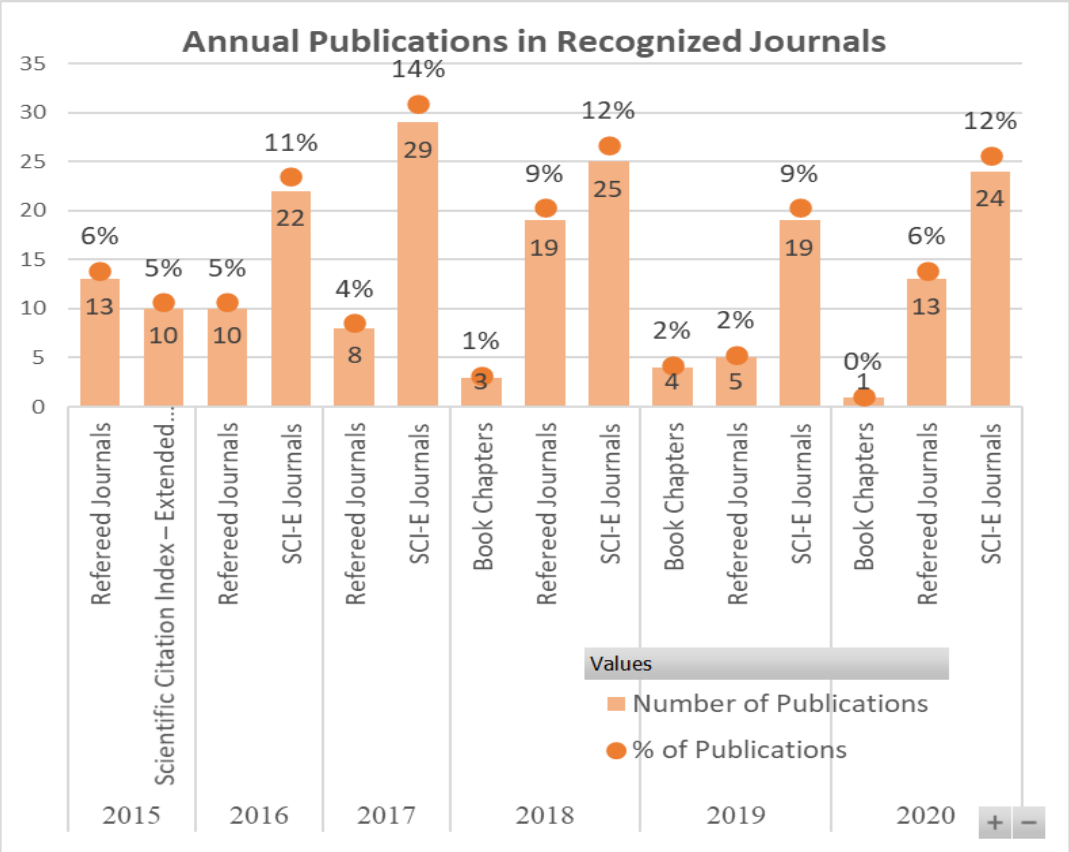
Table 45: Publications of Chapters, Refereed Journals, SCI-E Journals, Scientific Citation Index							
Count of Source	Year						
Source	2015	2016	2017	2018	2019	2020	Grand Total
Book Chapters				3	4	1	8
Refereed Journals	13	10	8	19	5	13	68
SCI-E Journals		22	29	25	19	24	119
Scientific Citation Index – Extended (SCI-E) Journals	10						10
Grand Total	23	32	37	47	28	38	205

As shown here, the distribution of publications have increased from 2015 to 2018 and then declined but showing some recovery in 2020.

Highest in Refereed Journals was published in 2018 (19), the highest in SCI-E Journals was in 2017 (29) and made a recovery in 2020 (24). Altogether 119 publications have been in SCI-E Journals during these five years while 68 has been in Refereed Journals.

The other aspect is the capacity of the scientists at the ITI to publish. We have studied in detail their capacity and the frequency shows that only one scientist has 37 publications while four have between 15 to 18. There are 8 by 1, 7 by 4, 6 by 2, 5 by 9, 4 by 10, 3 by 18, and 2 by 86. At least one publication has been made by 361 but the names include those who are joint publishers in the publications and not the lead authors.

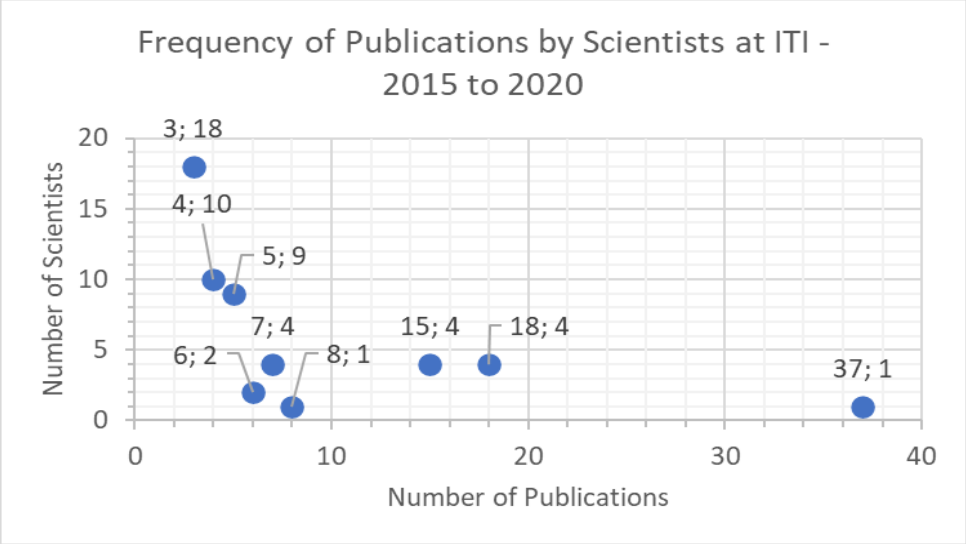
Figure 82: Annual Publications in Refereed Journals



Among the scientists those who have led the publications are as follows: 7 by 1, 5 by 1, 4 by 3, 3 by 7, 2 by 18. One publication each has been led by 124 scientists.

.

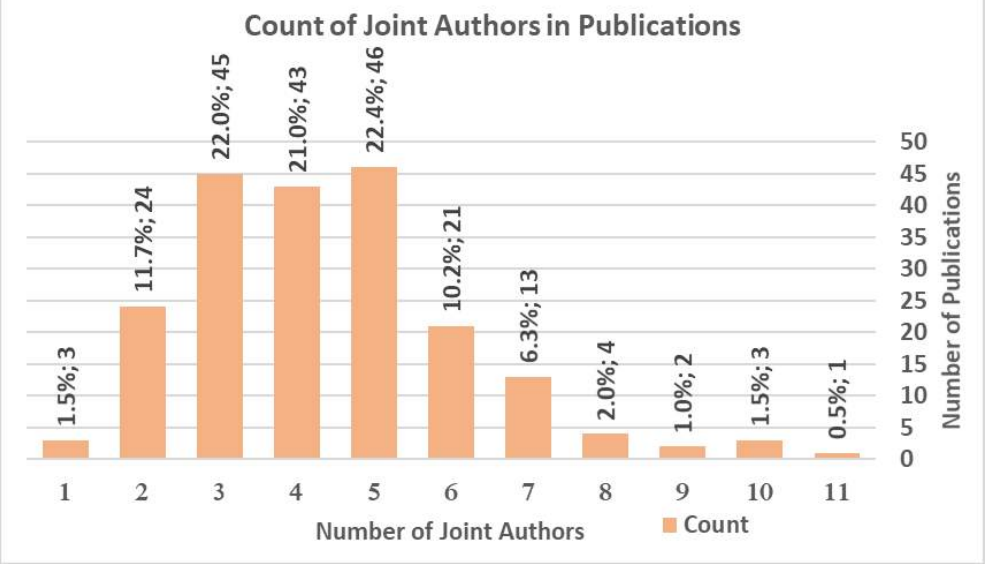
Figure 83: Frequency of Publications 2015 to 2020.



Joint Publications.

.

Figure 84: Joint Authorships.



.

The distribution of joint number of authors is ranging up to 11 from a single author. The highest numbers are with 3,4, and 5 authors and totals about 65% of all publications during the period of 2015 to 2020. Publications by a single author number only 3.

Funded Projects.

The time taken for completing projects is shown in the figure below. It shows that 51% of the projects have taken over three years to complete. 27% of the projects are completed in the 4th year of work and 23% of projects are completed in the 5th year.

Time Taken for Funded Projects

Table 46: Time Taken by Funded Projects

Months Taken	Funded By	Start Year	End Year	Count of Funds	Tech, Papers, Abs, Articles	Funded Projects
38-47	FP	2015	2018	1	29	19
38-47	FP	2016	2019	1	18	0
38-47	TG	2016	2019	1	12	2
38-47	TG	2016	2020	1	4	6
48-57	FP	2015	2019	1	13	4
48-57	TG	2015	2019	2	17	8
48-57	TG	2016	2020	1	10	4
58-67	TG	2013	2018	1	7	6
58-67	TG	2015	2019	1	11	4
Total				10	121	53

The following table examines the funded activities taken more than three year for completion. There have been 10 occasions when funds have been dispensed to ITI either as FP, TG or other sources.

The projects that have taken up time more than three years are given below. A complete list of Funded Projects are given in Annex 2.

Table 47: Projects, Duration and Funds

Duration Months	Project Title	Sum of Fund Rs.Mil
37	Cloning thermostable alpha amylase gene into Pichia pastoris and optimization of large scale thermostable alpha amylase enzyme production using a fermenter	0.61
37	Development of molecular based testing for Genetically Modified (GM) food items and diagnostic tests for food borne pathogens	3.40
37	Development of Red-clay based water filter/apparatus for the removal of hardness of drinking water	1.00
37	Development of technologies for sustainable raw material production for cosmetic industry using endemic Gyrinops walla gaertn (Sin. Walla Patta) – an endemic, industrial potential, lucrative fragrance plant grown in Sri Lanka	4.74
37	Rapid determination of coconut oil authenticity and quality with NIR spectroscopy	2.50
37	Rapid extraction of medicinal & aromatic plants and flowers & selective isolation of compounds by microwaves	2.00
37	Reduction of vehicle exhaust emissions by nanoparticle supported adsorption media	2.00
39	Enhanced preservation of fruits using nanotechnology	54.64

42	Biodiversity and Technological Potential of Micro-flora from Selected Sri Lankan Dairies	2.00
46	Degradation kinetics of Glyphosphate residues, metabolites and additives in conventional fields of application and simulated environments	2.49
49	Microbial bioremediation of petroleum hydrocarbon contaminated soil & water	2.50
59	Capacity building for the development of monoclonal antibodies against Dengue virus and to determine the feasibility of a nanomaterial to anchor the developed antibodies	4.40
60	Investigation on natural fragrances and other volatiles from Sri Lanka flora and their industrial applications	3.20
Total		85.48

Specialization Areas of Funding

In the disbursements of funds, we can also identify the laboratories that benefited as follows. The total amount of funds involved is Rs.102.21million. Food Technology and Materials Technology area is the most benefited with Rs.54.64million.

Table 48: Funding Received in Specialization Areas

Area of Specialization	Sum of Fund Rs. Mill
Food Technology and Materials Technology	54.64
Biotechnology	11.71
Herbal Technology	10.79
Food Technology	6.58
Herbal Technology	3.20
Material Technology	3.00
Quality Assurance	2.50
Environment Technology	2.50
Chemical and Microbiological	2.49
Residual analysis and Microbiology	2.00
Residue Analysis	1.50
Environmental Technology	1.00
Electro Technology	0.30
Grand Total	102.21

The funding sources and the amounts received are as follows. Funds have been granted to ITI from 2013 up to 2018 according to the record. Disbursement of these funds to ITI is shown in the columns from 2017 to 2020. A total of Rs.102.21million made up of Rs.54.64million from IDRC Canada, Rs.45.57million from TG and Rs.2.00million from NSF have been received. Annex 2 shows how and where these funds have been used.

Sources of Funding.

- Government treasury funds for salary payment / capital equipment.
- International grants- IDRC, Indo Sri Lanka, INBAR, China-Sri Lanka Collaboration.
- Local Funding agencies – NSF, NRC funds to conduct R&D projects.
- ITI /Treasury funds to conduct R&D projects.
- Contract projects funded by industries / Ministries / NGOs / Other national and International associations.

Table 49: The Funding Source, Amount and Time Taken						
Sum of Fund						
Funding Source	From	2017	2018	2019	2020	Grand Total
IDRC, Canada	2015		54.64			54.64
TG	2013		3.20			3.20
TG	2014	0.61				0.61
TG	2015	3.18		6.90		10.08
TG	2016	0.50	5.60	15.64	2.49	24.23
TG	2017		0.90	3.50		4.40
TG	2018			3.05		3.05
TG Total		4.29	9.70	29.09	2.49	45.57
NSF				2.00		2.00
Grand Total		4.29	64.34	31.09	2.49	102.21

.

Completed and Ongoing Projects

Table 50: Completed and Ongoing Projects			
Year	Status	Count of On-going	Percent
2017	Completed	9	9%
	On Going	7	7%
2018	Completed	14	15%
	On Going	17	18%
2019	Completed	25	26%
	On Going	24	25%
Total		96	100%

Table 51: Projects Summary		
On-going	Status	Percent
Completed	48	50%
Ongoing	48	50%
Grand Total	96	100%

.

.

.

.

.

Ironically, the information provided shows that exactly 48 projects are ongoing and 48 have completed making a total of 96 projects. The detail is given in.

Avenues of Expansion into Modern Technology

We are suggesting some areas where ITI could expand its products and service profile with an aim to elevating the international presence and market development. These are intended for ITI to investigate closely and strategize their market entry. It is also intended to promote Sri Lankan innovators to engage with ITI on product development.

(The content of the expansion areas are inspired by searching the KAIST website and information available on Nanoscience in Wikipedia)

1. Nanoscience[6]

Foods

Bacteria identification and food quality monitoring using biosensors; intelligent, active, and smart food packaging systems; nanoencapsulation of bioactive food compounds; production, processing, safety and packaging of food; nanocomposite coating to improve food packaging by placing anti-microbial agents directly on the surface of the coated film; Nanocomposites could increase or decrease gas permeability of different fillers as is needed for different products; Nanocomposites to improve the mechanical and heat-resistance properties and lower the oxygen transmission rate.

1.1. Nano-foods

New foods are among the nanotechnology-created consumer products coming onto the market at the rate of 3 to 4 per week, according to the Project on Emerging Nanotechnologies (PEN), based on an inventory it has drawn up of 609 known or claimed nano-products. On PEN's list are three foods—a brand of canola cooking oil called Canola Active Oil, a tea called Nanotea and a chocolate diet shake called Nanoceuticals Slim Shake Chocolate.

2. Consumer goods
   2.1. Surfaces and coatings

The most prominent application of nanotechnology in the household is self-cleaning or "easy-to-clean" surfaces on ceramics or glasses. Nanoceramic particles have improved the smoothness and heat resistance of common household equipment such as the flat iron.

2.2. Textiles

The first sunglasses using protective and anti-reflective ultrathin polymer coatings are on the market. For optics, nanotechnology also offers scratch resistant surface coatings based on nanocomposites. Nano-optics could allow for an increase in precision of pupil repair and other types of laser eye surgery.

[6] (Source: Wikipedia - https://en.wikipedia.org/wiki/Industrial_applications_of_nanotechnology)

2.3. Cosmetics

One field of application is in sunscreens. The traditional chemical UV protection approach suffers from its poor long-term stability. A sunscreen based on mineral nanoparticles such as titanium oxide offer several advantages. Titanium oxide nanoparticles have a comparable UV protection property as the bulk material but lose the cosmetically undesirable whitening as the particle size is decreased.

3. Sports

Materials for new athletic shoes may be made in order to make the shoe lighter (and the athlete faster). Baseball bats already on the market are made with carbon nanotubes that reinforce the resin, which is said to improve its performance by making it lighter. Other items such as sport towels, yoga mats, exercise mats are on the market and used by players in the National Football League, which use antimicrobial nanotechnology.

4. Aerospace and vehicle manufacturers

Lighter and stronger materials will be of immense use to aircraft manufacturers, spacecraft, vehicles, to reduce the size of equipment and thereby decrease fuel-consumption required to get it airborne. Hang gliders may be able to halve their weight while increasing their strength and toughness through the use of nanotech materials. Nanotech is lowering the mass of supercapacitors that will increasingly be used to give power to assistive electrical motors for launching hang gliders off flatland to thermal-chasing altitudes.

5. Military

5.1. Biological sensors

Nanotechnology can improve the military's ability to detect biological agents, the military would be able to create sensor systems that could detect biological agents. The sensor systems are already well developed and will be one of the first forms of nanotechnology that the military will start to use.

5.2. Uniform material

Nanoparticles can be injected into the material on soldiers' uniforms to increase durability and protect from dangers such as high temperatures, impacts and chemicals. Mobile pigment nanoparticles injected into the material can produce a better form of camouflage and also provide thermal camouflage in the night. Surfaces of many different military items can be designed in a way that electromagnetic radiation can help lower the infrared signatures, both the soldiers and the military vehicles and provide better protection from infrared guided weapons or infrared surveillance sensors.

5.3. Communication method

There is a way to use nanoparticles to create coated polymer threads that can be woven into soldiers' uniforms. These polymer threads could be used as a form of communication between the soldiers. The system of threads in the uniforms could be set to different light wavelengths, eliminating the ability for anyone else to listen in. This would lower the risk of having anything intercepted by unwanted listeners.

5.4. Medical system

A medical surveillance system for soldiers to wear can be made using nanotechnology to watch over their health and stress levels and releasing drugs or compressing wounds, as necessary. The system would be able to inform the medics at base of the soldier's health status at all times that the soldier is wearing the system. The energy needed to communicate this information back to base would be produced through the soldier's body movements.

5.5. Weapons

"Nanoweapon" is the name given to military technology currently under development which seeks to exploit the power of nanotechnology in the modern battlefield.

5.6. Risks in military

People such as state agencies, criminals and enterprises could use nano-robots to eavesdrop on conversations held in private. There are very strict regulations on the scientists that manufacture products with nanoparticles. With these strict regulations, they are able to largely decrease the danger of nanoparticles wearing off of materials and entering the soldiers' systems.

5.7. Catalysis

Chemical catalysis benefits especially from nanoparticles, due to the extremely large surface-to-volume ratio. The application potential of nanoparticles in catalysis ranges from fuel cell to catalytic converters and photocatalytic devices. Catalysis is also important for the production of chemicals. Platinum nanoparticles are being considered in the next generation of automotive catalytic converters because the very high surface area of nanoparticles could reduce the amount of platinum required.

6. Construction

Nanotechnology has the potential to make construction faster, cheaper, safer, and more varied and at much lower cost. In the near future, Nanotechnology can be used to sense cracks in foundations of architecture and can send nanobots to repair them. Nanotechnology is an active research area that encompasses a number of disciplines such as electronics, bio-mechanics and coatings. These disciplines assist in the areas of civil engineering and construction materials.

6.1. Cement

One of the fundamental aspects of nanotechnology is its interdisciplinary nature and there has already been cross over research between the mechanical modeling of bones for medical engineering to that of concrete which has enabled the study of chloride diffusion in concrete (which causes corrosion of reinforcement). Particle packing in concrete can be improved by using nano-silica which leads to a densifying of the micro and nanostructure resulting in improved mechanical properties. Nano-silica addition to cement based materials can also control the degradation of the fundamental C-S-H as well as block water penetration and therefore lead to improvements in durability.

6.2. Steel

The use of nanotechnology in steel helps to improve the physical properties of steel. Fatigue, or the structural failure of steel, is due to cyclic loading. Current steel designs are based on the reduction in the allowable stress, service life or regular inspection regime. This has a significant impact on the life-cycle costs of structures and limits the effective use of resources. Stress risers are responsible for initiating cracks from which fatigue failure results. The addition of copper nanoparticles reduces the surface un-evenness of steel, which then limits the number of stress risers and hence fatigue cracking. Steel cables can be strengthened using carbon nanotubes. The use of vanadium and molybdenum nanoparticles improves the delayed fracture problems associated with high strength bolts improves steel micro-structure by reducing the effects of the inter-granular cementite phase. The addition of nanoparticles such as magnesium and calcium makes the HAZ grains finer in plate steel. This nanoparticle addition leads to an increase in weld strength.

6.3. Wood

Wood is also composed of nanotubes or “nanofibrils”; namely, lignocellulosic (woody tissue) elements which are twice as strong as steel. Harvesting these nanofibrils would lead to a new paradigm in sustainable construction as both the production and use would be part of a renewable cycle. It could open new opportunities for such things as self-sterilizing surfaces, internal self-repair, and electronic lignocellulosic devices. These non-obtrusive active or passive nanoscale sensors would provide feedback on product performance and environmental conditions during service by monitoring structural loads, temperatures, moisture content, decay fungi, heat losses or gains, and loss of conditioned air. Currently, however, research in these areas appears limited.

6.4. Glass

Titanium dioxide (TiO2) nanoparticles are used to coat glazing since it has sterilizing and anti-fouling properties. The particles catalyze powerful reactions that break down organic pollutants, volatile organic compounds and bacterial membranes. TiO2 is hydrophilic (attraction to water), which can attract rain drops that then wash off the dirt particles. Fire-protective glass is achieved by using a clear intumescent layer sandwiched between glass panels (an interlayer) formed of silica nanoparticles (SiO2), which turns into a rigid and opaque fire shield when heated. The nanotechnology can provide a better solution to block light and heat coming through windows.

6.5. Coatings

Nanotechnology is being applied to paints to obtain the coatings having self-healing capabilities and corrosion protection under insulation. Since these coatings are hydrophobic and repels water from the metal pipe and can also protect metal from saltwater attack. Nanoparticle based systems can provide better adhesion and transparency. The TiO2 coating captures and breaks down organic and inorganic air pollutants by a photocatalytic process, which leads to putting roads to good environmental use.

6.6. Fire Protection and detection

The nano-cement has the potential to create a new paradigm in this area of application because the resulting material can be used as a tough, durable, high temperature coating. It provides a good method of increasing fire resistance and this is a cheaper option than conventional insulation.

6.7. Risks in construction

The self-healing concrete, materials to block ultraviolet and infrared radiation, smog-eating coatings and light-emitting walls and ceilings are the new nanomaterials in construction. Nanotechnology is a promise for making the "smart home" a reality. Nanotech-enabled sensors can monitor temperature, humidity, and airborne toxins, which needs nanotech-based improved batteries. The building components will be intelligent and interactive since the sensor uses wireless components that can collect a wide range of data.

Effect of nanoparticles on health and environment: Nanoparticles may also enter the body if building water supplies are filtered through commercially available nano filters. Airborne and waterborne nanoparticles enter from building ventilation and wastewater systems.

Effect of nanoparticles on societal issues: As sensors become commonplace, a loss of privacy and autonomy may result from users interacting with increasingly intelligent building components.

7. Life Science and Bioengineering

7.1. Medical Science and Engineering:

Biomedical engineering applications include the development of biocompatible prostheses, various diagnostic and therapeutic medical devices ranging from clinical equipment to micro-implants, common imaging equipment such as MRIs and EKG/ECGs, regenerative tissue growth, pharmaceutical drugs and therapeutic ...

8. Engineering

8.1. Mechanical Engineering:

Mechanical engineering is the study of maintaining, analyzing, designing and manufacturing machinery. Following areas included in mechanical engineering are Applied Mechanics, Fluids Engineering, Heat Transfer, Bioengineering, Tribology, Energy Conversion, Internal Combustion Engines, Fuels & Combustion Technologies, Energy Resources, Nuclear Engineering, Solar Engineering, etc.

8.2. Aerospace Engineering

Aerospace engineering is the design, construction and maintenance of aircraft, spacecraft, missiles and weapons systems. It has two major and overlapping branches: aeronautical engineering and astronautical engineering. Avionics engineering is similar but deals with the electronics side of aerospace engineering.

8.3. Electrical Engineering:

Electrical Engineering Work on applications of electricity in order to control systems or signal processing for Electric motors, Machinery controls, Lighting and wiring in buildings, Radar and

navigation systems, Communications systems, Power generation, control, and transmission devices used by electric utilities, etc,.

8.4. Computing

Computing is the rapidly increasing part of modern life. Millions of servers in data centers all over the world handle enormous loads of data for everything from homes to offices and in every sphere of life. It has become useful for many online applications such as bill payment, watching movies or shows at home, home tutoring, social media access, playing games, internet access, etc. In professional work such as the Medical Field, Entertainment, Industry, Education, Government, Banking, and Business. The 4IR is a manifestation of the vast computer knowledge.

8.5. Civil and Environmental Engineering

Civil Engineering involves with the built environment. Environmental Engineering involves sustainable design for the control and protection of the environment and its resources. Environmental engineers design systems for water quality and treatment, wastewater treatment, hazardous waste management and treatment and control of air pollutants.

8.6. Bio and Brain Engineering

Bio and Brain Engineering discovers new knowledge regarding all forms of life including the brain and by developing and industrializing technology that is applied in engineering.

8.7. Industrial Design

Industrial design is a process of design applied to products that are to be manufactured through techniques of mass production.

8.8. Industrial and Systems Engineering

Industrial and systems engineering (ISE) is concerned with the design, improvement and installation of integrated systems of people, materials, information, equipment and energy. It draws upon specialized knowledge and skill in the mathematical, physical, and social sciences together with the principles and methods of engineering analysis and design, to specify, predict, and evaluate the results to be obtained from such systems.

8.9. Knowledge Service Engineering

Knowledge Service Engineering is a new field of activity when we live in a knowledge society where human’s knowledge-intensive tasks, centered on decision-making, become increasingly more critical and valuable components throughout our economy activities, ranging from the conventional manufacturing and transportation systems to the financial, educational, government and social systems. Human cognition limitation is unable to make use of the vast knowledge freely available for rapid and effective decision making. KSE takes care of this aspect.

8.10. Chemical and Biomolecular Engineering

This field is creating life-saving medicines, advancing fuel cell research, or developing the next big food item to hit grocery store shelves. It is about improving things that people use every day while reducing their cost.

8.11. Materials Science and Engineering

Materials Science and Engineering is the design and discovery of new materials, particularly solids. Materials science is a syncretic discipline hybridizing metallurgy, ceramics, solid-state physics, and chemistry. It is the first example of a new academic discipline emerging by fusion rather than fission.

8.12. Information and Communications Engineering

Information and Communication Engineering is the integration of Information technology, Communication and Information Systems, and Optical Engineering.

8.13. Green Transportation

It is Sustainable Transportation and comprises of those modes of transportation that do not depend on diminishing natural resources like fossil fuels. These transportation modes rely on renewable energy sources.

8.14. EEWS (Energy, Environment, Water, and Sustainability)

EEWS is the foundation of human beings sustenance and the study of its interconnectivity and management.

8.15. AI

Artificial Intelligence is driving 4IR. Artificial intelligence is intelligence demonstrated by machines, unlike the natural intelligence displayed by humans and animals, which involves consciousness and emotionality.

Comments, Conclusions, & Recommendations.

Table 52: Comments, Conclusions, and Recommendations

SUBJECT AREAS	REVIEW CONTENT
Weak Areas	Commercialization and Royalties
Comments	A deficiency of recovering royalty payments for technology transfers is apparent.
Conclusions	There is no proper follow up and taking action for recovery of royalty dues.
Recommendation	Systematic follow up and action should be introduced to duly recover royalty payments
Impact Areas	Productivity
Weak Areas	Commercialization and Royalties
Comments	Commercialization of Technology Transfers are not in order. Technology transfer MOU states to commercialize the technology within 06 months. But practically it does not happen. No legal action taken so far, No legal officer at the moment (by Nov 2020).
Conclusions	The conditions given in the MOU signed between the Customer and the ITI but there is no proper mechanism to follow up whether the conditions given in the MOU are implemented.
Recommendation	Take legal action if the conditions are violated.
Impact Areas	Recovery
Weak Areas	Commercialization and Royalties
Comments	Sometimes, the customers buy the technology to prevent their competitors in the market. No Legal officer to take action on Royalty earnings. Most Industries do not pay this after getting patents:
Conclusions	The system in place for collecting dues must be made robust.
Recommendation	Recruit a Legal officer without delay.
Impact Areas	Responsibility
Weak Areas	National Needs and Multidisciplinary R&D
Comments	Multidisciplinary projects are very few in comparison to other projects.

Conclusions	Out of 65 research projects, there were several multidisciplinary projects.
Recommendation	More Multidisciplinary projects are recommended.
Impact Areas	Productivity
Weak Areas	National Needs and Multidisciplinary R&D
Comments	Prioritized selection of research for national development
Conclusions	There appears no systematic selection of prioritized national needs for R&D
Recommendation	For R&D the national requirements should come from senior level officers and should be given high priority in project planning.
Impact Areas	Growth
Weak Areas	National Needs and Multidisciplinary R&D
Comments	Multidisciplinary projects are very few in comparison to other projects.
Conclusions	There is no clear idea about when and where to commence multidisciplinary research
Recommendation	It is important to have a set target to achieve on multidisciplinary research.
Impact Areas	Objectives
Weak Areas	Technology Transfer
Comments	Technology transfer is not efficient
Conclusions	ITI does not take views from the industry in planning R&D projects.
Recommendation	Strengthen the Technology Transfer job families to facilitate technology transfers.
Impact Areas	Responsibility
Weak Areas	Technology Transfer
Comments	Communication of the customer needs is weak.
Conclusions	Communicating the Customer needs to the solution providers must be made more efficient.

Recommendation	Customers' R&D needs to be understood by the Technology Transfer job family and to pass the same to the research divisions to plan and implement the R&D projects.
Impact Areas	Initiative
Weak Areas	Absence of an integrated information system
Comments	An efficient communication system is not available within and with the customers
Conclusions	The customers should be given prompt information as and when needed. However, they should not have access to the persons engaged in the testing work for a customer.
Recommendation	Develop online communication system for customer inquiries and introduce a communication system which is independent from direct access to laboratories. In the event a customer relations officer engaging with providing such information the officer should be able to upload the screen for the customer online.
Impact Areas	Customer Value
Weak Areas	Absence of an integrated information system
Comments	Inadequate information available on the progress of work on samples submitted by customers and difficulty of communicating through the normal channels.
Conclusions	There is no proper mechanism to check the status of the samples submitted by customers, unless they call the respective laboratory and poor communication through the receptionist on some occasions.
Recommendation	Integrate the information into the Laboratory Information Management System (LIMS/ERP) and customer should be able to monitor the progress of work on the samples submitted by them.
Impact Areas	Customer Value
Weak Areas	Absence of an integrated information system
Comments	Poor Digitalization process. No technically qualified Senior Deputy director appointed at the Computer & Communication section. Senior Deputy Director, Electro Technical Laboratory is working on acting basis since 2007. Senior computer system engineer post- vacant.

Conclusions	At the moment computer & communication section working without fully qualified senior position personnel. No automated report generation system in place
Recommendation	Digitalization of the Institutes information system from end to end should be given high priority in the context. ITI should implement proper ERP system integrated with LIMS to cater the needs of the institutional work to increase the efficiency and also to cater the customer satisfaction on the ITI services for e.g., getting the status of the testing online.
Impact Areas	Information Capital
Weak Areas	Equity and Motivation
Comments	The Research Scientists in R&D sections have opportunity to get more Ph.D., M.Sc., publications, abstracts etc. when compared to the scientists in Technology services where mainly Testing and earning is done. The Research Scientists in Testing laboratories have lesser time for research when compared with the Research scientist in R&D sections.
Conclusions	Even within the same category of Scientists there is a division of opportunities.
Recommendation	To introduce a rotation scheme for Research Scientists & Research technologists periodically.
Impact Areas	Organization Capital
Weak Areas	Rational use of Resources
Comments	There is no National control and communication over R & D projects done by various Institutes and ministries. Therefore, possibility of repeating the same or similar projects in multiple institutions.
Conclusions	There is no proper system & possibility for ITI to get information on R&D work done in other institutions in the country when planning R&D.
Recommendation	Recommend having a NASTEC as a repository of R&D information from where all the data on current R&D work done in the country could be obtained.
Impact Areas	Productivity
Weak Areas	Industry Connectivity
Comments	Industry & ITI not well connected.:

Conclusions	No board member from Ministry of Industries on the ITI Board.
Recommendation	ITI has to work very closely with ministry of Industries to get a better understanding about the current needs of the Industry and have a board member from Ministry of Industries.
Impact Areas	Customer Value
Weak Areas	Image Weakness
Comments	Customer perception of ITI as a value addition
Conclusions	The Name ITI is misunderstood as an IT related institute
Recommendation	Avoid image confusion to improve customer value generation by designing marketing with the label "Industrial Technology" rather than "ITI"
Impact Areas	Customer Value
Weak Areas	Commercialization and Royalties
Comments	Commercialization & Joint venture with industries' are not granted to ITI through Science and Technology Development Act. E.g., Recently Hand Sanitizers were commercialized on cabinet approval. ITI has already developed products but no provisions to enter into commercial arrangements.
Conclusions	ITI has no commercialization powers.
Recommendation	As a government institute engaged in developing commercial intellectual products ITI should be given the authority to operate through the entire commercial value chain and be held responsible for the outcomes.
Impact Areas	Customer Value
Weak Areas	Technology Transfer
Comments	Most of the Technologies developed at ITI are not transferred to Farmer level. E.g. Even though they developed Bio Wax to dip mango, king coconut etc, & spray Hexanal to keep the fruit for one month in the tree itself, those technologies have not gone to farmer level.
Conclusions	ITI has no established system for marketing at farmer level and educating them on new technologies.
Recommendation	Have a commercial value generating systematic promotion programs about newly developed technologies to the farmers and enable selling products to farmers.

	The marketing system should be able work out profitable partnerships to produce and sell these products instead of opening factories belonging to ITI.
Impact Areas	Customer Value
Weak Areas	Environment Management
Comments	ITI has to survey & monitor the environment pollution and to recommend remedial measures to mitigate such pollutions. During last five years ITI has done several projects and introduced solutions in this regard. However, solid waste management which is a priority area and with high national need did not get attention.
Conclusions	ITI has taken action on Poultry Wastewater disposal, Air pollution control, Sound pollution, etc, but not solid waste management.
Recommendation	Commercially viable solid waste management should be one ongoing project.
Impact Areas	Solid waste management
Weak Areas	Environment Management
Comments	No, Environmental Scientist, no Environmental Economist, therefore when doing EIA – sometimes need to hire people from Environmental Scientists, Hydrologists etc.
Conclusions	One of the main functions of ITI in the countries high priority needs is environmental protection. There is a lack of personnel with required knowledge.
Recommendation	To recruit Environmental Scientists with knowledge of environmental economics with required qualifications.
Impact Areas	Responsibility
Weak Areas	Human Capital
Comments	Key administrative positions were vacant for many years
Conclusions	The system in place for recruitment at senior level does not promote a succession plan within ITI. The system does not promote rapid filling of vacancies due to several constraints.: The system in place does not develop several people with the necessary multiple skills to fill the jobs that fall vacant.
Recommendation	The assessment of jobs needed to function effectively should be constantly monitored (six month intervals) due to rapid changing technology situation

	in the market.: Budgetary allocations for new positions should be based on a revenue generation plan (business plan).:As a commercial organization the justification of all jobs should be based on job families from top to bottom and made accountable for achievements.: There are many types of jobs that can be used to fill vacancies – Temporary, Contract, and Outsourced. These types must be used without causing undue delays to operations.
Impact Areas	Productivity
Weak Areas	Strategy Weakness
Comments	Absence of Strategic plans
Conclusions	ITI did not have Strategic Plans from 2017 to 2019..
Recommendation	Preparation of strategic plans should be done every year and develop regular monitoring and system for taking corrective action system for them.
Impact Areas	Drivers and Outcomes
Weak Areas	Customer Relationships Management
Comments	Stakeholder feedbacks to upgrade the standard / quality of activities
Conclusions	Only annual reviews were available. Evidence of evaluation actions taken for prompt corrections were not available.
Recommendation	Introduce systematic evaluation method for customer feedbacks.: Take measure to introduce immediate action on customer complaints.: Suggest appointing a committee comprising of an external CRM specialist to evaluate the stakeholder feedback and take corrective action for better managing CRM.
Impact Areas	Customer Value
Weak Areas	Fiduciary Responsibility Weakness
Comments	ITI revenue generation is inadequate to sustain some divisions that are conducting commercial operations.
Conclusions	ITI has not considered the returns on the projects undertaken to make such projects profitable in such a way that they generate funds over and above the investment.
Recommendation	Introduce targeted research & development activities each year and include in the action plan of the year.:

Impact Areas	Productivity
Weak Areas	Costing and Finance
Comments	There is no proper mechanism used for costing of products and services developed by ITI.
Conclusions	All aspects of costs of production have to be taken into account in costing. Application of averages in all products for costing is unsatisfactory when considering additional costs involved in dealing with some customers. Therefore, a fair system that customers also can understand should be developed. There should be accountability for time spent on projects that does not generate direct revenue.
Recommendation	Appoint an expert committee to carry out costing of products /technology transfer prior to initiate each R & D activity.: Examine the costs outside the machinery time in laboratories in testing services so that customers are charged for those additional costs.
Impact Areas	Cost Efficiency
Weak Areas	Learning & Growth Weakness
Comments	Participation of the staff who conduct research other than the administration levels for program planning in each year is not at satisfactory level.
Conclusions	It was revealed that comments given by research staff are not considered when planning program of the year.
Recommendation	The feedback from the job family involved in analytical and research work should be given due consideration to prepare program plan.
Impact Areas	Productivity
Weak Areas	Strategy Weakness
Comments	SDDs are given the responsibility to achieve the financial and nonfinancial targets stated in each of the program.
Conclusions	Nonfinancial targets take time and money. Thus, those are to be costed into the expenditure, which has to be recovered in full.:
Recommendation	The strategy should connect the intangibles to the tangible outcomes and should be reflected in the strategic plan. Then the annual budgets should take these strategic objectives into the action plan and assign responsibilities to the officers down the line.

Impact Areas	Productivity
Weak Areas	Technology Transfer
Comments	A deficiency in transferring Technologies appears in the numbers.
Conclusions	It was revealed that although more than 90 technologies developed during the review period, only about six technologies were transferred. There are claims of technologies transferred but the review team has reservations about these claims due to difficulty of information verification.
Recommendation	Development of technologies should be done with market information so that the technologies developed could find buyers.
Impact Areas	Productivity
Weak Areas	Technology Capital
Comments	Capacity utilization of State-of-the-art machines and equipment available in the laboratories for testing and research purposes is not known by the management.
Conclusions	Some of the equipment available in the research laboratories were underutilized and not maintained properly using logbooks.
Recommendation	It is necessary to have a machine capacity utilization information system for each of the machines and equipment and action to use underutilized machines and equipment in a more productive way. This may be achieved with the new LIMS/ERP system.
Impact Areas	Productivity
Weak Areas	Human Capital
Comments	The review team could not meet the Internal Auditor.
Conclusions	It is not clear whether ITI has the proper audit controls and risk management processes in place in the absence of an Internal Auditor
Recommendation	Appoint an internal auditor.
Impact Areas	Accountability
Weak Areas	Human Capital
Comments	Recruitment of Research Technologist and Assistant Research Technologist
Conclusions	It was revealed that most of the RT and ART are overqualified as they are degree holders or sometimes they have done postgraduate degrees as

	well.: The SOR has several weaknesses to be examined and rectified in consultation with the DMS.
Recommendation	The existence of two categories of employees as Technologists and Research Scientists are leading to frustrations because one being considered below the other but having similar or even better qualifications with the lesser category. Thus, if possible avoid recruiting overqualified people in the lesser category until the two systems could be unified. It is strongly suggested to bring all laboratories under the Tech Services Division and to work on a strategy to make all labs generate revenue to break even.
Impact Areas	Restructure
Weak Areas	Commercialization and Royalties
Comments	There was no evidence of any -public private partnership project successfully launched.
Conclusions	Not a single formal private-public partnership project conducted.
Recommendation	Strengthen private-public partnership and increase contribution to the socio-economy of the country.
Impact Areas	Productivity
Weak Areas	Human Capital
Comments	Dispute among research scientists in testing services and R&D sections
Conclusions	There were many comments from staff members during our discussions that engagement in research work is not equitable. This is also a matter regarding the incentive scheme.
Recommendation	Revise the existing incentive scheme with the help of external experts in order to motivate research scientists in testing services.
Impact Areas	Restructure
Weak Areas	Customer Relationships Management
Comments	90% of customers value online reviews higher than product descriptions by brands.
Conclusions	Adding an online review option to the ITI products and services is a technique of increasing the customer base and boosting sales.
Recommendation	Customers should have an instant feedback and review option online for information of the product and project managers at ITI.

Impact Areas	Customer Value
Weak Areas	Fiduciary Responsibility Weakness
Comments	The high value equipment should be data and internet enabled for remote operations.
Conclusions	These equipment should be connected with the digital system to integrate the services with customers.
Recommendation	Develop and install the digitized information system to connect the equipment, laboratories, HR, and customers for internal use and selectively for external use
Impact Areas	Productivity
Weak Areas	Process Management
Comments	Management should be enhanced with high value equipment utilization and management finding such information readily online.
Conclusions	Digitally connecting the equipment should enhance LRP system. This would involve the human resources assigned for overseeing the process, outcomes once the work gets assigned.
Recommendation	The assignment of testing should be promptly made at the reception when data enters the system at the reception. Ensure the customer to enter the data online prior to sending the samples and eliminate paper. (consider for e.g., how Uber operates)
Impact Areas	Productivity
Weak Areas	Process Management
Comments	The process management online is missing in the internal system.
Conclusions	No process management online.
Recommendation	The situation with all the work on going at the ITI should be observable online on metrics by the different authorities internally going up to the DG and Chairman.
Impact Areas	Productivity
Weak Areas	Customer Relationships Management
Comments	Churn rate is the percentage of customers you lost over a certain period is not quite well understood here.

Conclusions	Getting new customers is much more expensive than retaining the existing ones.
Recommendation	Thus, it is important to monitor churn, in order not to miss a negative trend. Monitoring of customer satisfaction and motivation should be the responsibility of all involved in the job family and particularly CRM.
Impact Areas	Productivity
Weak Areas	Customer Relationships Management
Comments	All modern fast developing companies have CRM at the highest level
Conclusions	The present customer monitoring system is outdated.
Recommendation	Develop new metrics such as the response times to customers and time to close.
Impact Areas	Objectives

Note:

Customers appreciate it when you value their time. include time-related metrics into your analytical toolset. First response time shows how long it takes for your agents to pick up a call or chat. Customers do not like to wait on hold, thus keep the first response time as short as possible. If you find that your customer service takes too long to respond, it may mean that you need more agents on board. Alternatively, think of introducing additional training courses for your agents, so that they handle customer requests quicker.

Time to close shows how long you take to resolve a customer issue. Again, this knowledge is important in the context of customers valuing their time and wanting their issues to be cleared as fast as possible.

Table 53: Weaknesses and Recommendations

Main Weaknesses	Count of Recommendations
Commercialization and Royalties	5
Customer Relationships Management	4
Technology Transfer	4
Human Capital	4
National Needs and Multidisciplinary R&D	3
Absence of an integrated information system	3
Fiduciary Responsibility	2
Process Management	2
Strategy	2
Environment Management	1

Equity and Motivation	1
Rational us of Resources	1
Costing and Finance	1
Learning & Growth	1
Technology Capital	1
Image	1
Environment Management	1
Industry Connectivity	1
Grand Total	38

Table 54: Main Impact Areas and Recommendations

Main Impact Area	Count of Recommendations
Productivity	14
Customer Value	8
Responsibility	3
Objectives	2
Restructure	2
Organization Capital	1
Recovery	1
Growth	1
Solid waste management	1
Cost Efficiency	1
Drivers and Outcomes	1
Information Capital	1
Accountability	1
Initiative	1
Grand Total	38

Annex 1 – The Status of Human Resources.

The 351 personnel who are holding the designated fulltime positions in the ITI are listed below under the 28 Offices.

Table 55: Status of HR with Office, Salary Code, Designation, & Name

Office	Salary Code	Designation	Name with Initials
ADG - A&O Office	PL3	Driver	P P K Pathirage
	PL2	Helper	K V D Sumith Kumara
	MA1-2	Management Assistant	Ms H A C Sanjeewani
	JM1-2	Management Officer	Ms. A I Bandara
	HM2-2	Additional Director General-Administration & Operation	Mr.K A S P Kaluarachchi
ADG - R&D Office	PL3	Driver	W W D Pushparaj
	MA2-2	Assistant Research Technologist	Ms M H T Dilhari
	JM1-2	Management Officer	Ms.W S K Fernando
	HM2-2	Additional Director General-R&D/ SDD-FTS Covering	Dr(Ms)I G N Hewajulige
ADG-TEC Serv Office	PL2	Lab Attendant	M A S N Rajarathne
	PL1	Helper	W M Sewwandi
	MM1-1	Senior Customer Liaison Officer	Ms. R Perera
	MA1-2	Management Assistant	Mr. D V W S Herath
			Mr. K S D Perera
			Ms R D Shehara
	JM1-2	Customer Liaison Officer	Mrs. K N Kalupahana
		Management Officer	Ms. A G A H Abeysinghe
			Ms. W M R Swarnalatha
BTU- Biotechnology Section	PL2	Lab Attendant	D L Somasiri
	MA2-2	Assistant Research Technologist	Mr. M H T Dulaj
	MA1-2	Management Assistant	Ms. A M I Silva
	HM2-1	Senior Deputy Director - BTU/Research Fellow	Dr.R M Dharmadasa
	AR2	Senior Research Scientist	Dr (Ms) A M M H Athapaththu
			Dr (Ms) W W P Rodrigo
	AR1	Research Scientist	Ms B J G Jayawardena
			Ms. H H K Achala
			Ms. W T G S L Withana
Chairman's Office	PL3	Driver	D M P K Dissanayaka
	MM1-1	Confidential Secretary	Ms.H A A U Dias

Computer Unit	MM1-1	Senior Computer System Administrator	Mr.S S Wickramasekara
		Senior Research Technologist	Ms.N K Alagoda
	MA2-2	Computer System Assistant	Mr H M A I Herath
			Mr. G A M Dilshan
			Ms. E H Somaratne
	AR1	Computer System Engineer	Mr.M R M Nazeer
Director General's Office	PL3	Machinist	A M W Wijerathne
	PL1	Helper	G S C Manohara
	MM1-1	Confidential Secretary	Ms.H H S M R Wijenayake
	MA1-2	Management Assistant	Ms. M M Senarathne
			Ms.K I S Premarathna
	HM2-3	Director General	Dr(Ms)J K R R Samarasekera
ES -Engineering Services	PL3	Air Conditioner/Refrigerator	J M U Ranasinghe
			M W Dinesh Chamika
		Carpenter	G V D Sarath Kumara
			K A V S Kumara
			M U Nimalasiri
			N L Perera
		Driver	K A I Indika
		Electrician	A R S Athukorala
			H M H P Bandara
			K R D J Sujeewa
		Fitter	H D R Nilantha
		Motor Mechanic	W D P Sanjeewa
		Plumber	L G L Lakmal
		Welder	G M S M Aponsu
			R A K Priyalal
			S D K Sandaruwan
	PL2	Workshop Attendant	M Ratnasiri
			P H K De Silva
	PL1	Helper	P K L R Kumara
	MA2-2	Master Craftsman	Mr. W A S Indika
	MA1-2	Management Assistant	Mr. S A Sumendra
	JM1-2	Assistant Engineer - Premises	Mr. U I Gamhewa
			Mr.W H R J Jayakody
	HM1-3	Chief Engineer	Mr.A S Arachchi
ETS- Environment Technology Section	PL2	Lab Attendant	K Bogoda
	MM1-1	Senior Research Technologist	Mr.J A P V Jayasinghe
	MA2-2	Assistant Research Technologist	Mr V A Nishantha
			Ms W K H Prathibha

		Assistant Research Technologist	Ms. M W T P Priyanandana
		Draughtsman	Ms. L A D Y Athukorala
	HM1-3	Principal Research Engineer	Ms. W R L Wijesekera
		Senior Deputy Director-ETS/Principal Research Engineer	Mr.N A T D D Gunasekera
	AR2	Senior Research Engineer	Ms. D M H S Dissanayake
		Senior Research Scientist	Dr P Subramaniam
	AR1	Research Engineer	Ms A H S Jayasekera
			Ms H L G S Liyanage
			Ms. K A N Kumarasinghe
		Research Scientist	Mr. R D S S Ranathunga
			Ms. R T Nilusha
FTS- Food Technology Section	PL3	Senior Lab Attendant	A S Amarathunga
	PL2	Lab Attendant	D N Amarasinghe
	PL1	Helper	A M H S Chandrasiri
			H V C Soysa
	MM1-1	Senior Research Technologist	Mr.W U D Medis
			Ms.M G D Shiranthi Perera
	MA2-2	Assistant Research Technologist	Ms M D Jayasinghe
			Ms S L Liyanage
	MA1-2	Management Assistant	Ms. U Weerasinghe
	JM1-2	Management Officer	Ms. M D L C Gunathilake
		Research Technologist	Ms. A W D Priyangani
			Ms.T M D A Jayawardena
	HM1-3	Principal Research Scientist	Dr P N R J Amunugoda
			Dr(Ms)H M T Herath
	AR2	Senior Research Scientist	Ms. D U Rajawardana
	AR1	Research Engineer	Ms. A B G C J De Silva
		Research Scientist	Dr(Ms) D M W D Divisekara
			Mr. K V T Gunawardhana
			Mr. M M N P Gunasekara
			Mr. S S K Madage
			Ms. A M C U Binduhewa
			Ms. D A V Nilukshi
			Ms. M D W Samaranayake
			Ms. R C Pitipanaarachchi
			Ms. S A S Jayawardana
HRD Human Resources Department	PL1	Helper	K K D M Madushanka
	MA1-2	Management Assistant	Mr. I D D S Piyawansha

			Ms. J N A Weerasinghe
			Ms. W M D M Dilini
			Ms. Y G R Thushari
	JM1-2	Administrative Officer	Ms. L N Perera
		Human Resources Officer	Ms. W V P Sarojinie
		Senior Administrative Officer(HR)	Mr.U A Thilakasiri
HTS- Herbal Technology Section	PL2	Lab Attendant	S A C Pradeep
	PL1	Helper	H Harshana Dilshan
	MM1-1	Senior Research Technologist	Ms.P I P K Fernando
			Ms.V S Bandara
	MA2-2	Assistant Research Technologist	Ms A A P R Perera
			Ms. K A M S Kumarapeli
		Assistant Research Technologist	Mr. H H U Chanaka
			Mr. U K A Samarasinghe
			Ms. D L S M Jayaratne
	MA1-2	Management Assistant	Mr. I P G I Keerthisinghe
	JM1-2	Management Officer	Ms. M D L Champika Gunathilaka
	HM2-1	Research Fellow	Dr.T D C M K Wijayasiriwardana
		Senior Deputy Director - HTS/Research Fellow	Dr.P Ranasinghe
	HM1-3	Principal Research Scientist	Dr(Ms)L D A M Arawwawala
			Dr(Ms)S Chelvendran
	AR2	Senior Research Scientist	Mr. H D Weeratunga
	AR1	Research Scientist	Ms S A D P S Jayawardhane
			Ms. H D S M Perera
			Ms. L A G Dilkhushi
			Ms. U I Medawatta
IML - Industrial Metrology Lab	PL2	Helper	B S S Rodrigo
		Lab Attendant	N V I Prasajith
	MM1-1	Senior Research Technologist	Mr.T N P K Peiris
	MA2-2	Assistant Research Technologist	Mr M K C Nimalasiri
			Mr. M M H Rishad
			Mr.K G A Gunawardhana
		Assistant Research Technologist	Ms. L S Vithanawasam
	MA1-2	Management Assistant	Mr P P A Madhusanka
			Ms M V P Fernando

	JM1-2	Management Officer	Ms. B L U R Kumari
			Ms. R P D Vonhagt
		Research Technologist	Mr. S P C Padmaharsha
			Mr. T G N B Karunathilaka
	HM1-3	Senior Deputy Director - IML/Principal Research Scientist	Dr.W M S Wijesinghe
	AR2	Senior Research Scientist	Ms. G D T A Pathiragoda
	AR1	Research Scientist	Mr M D R De Costa
			Mr. R A D S D Ranasinghe
			Ms.K B G K I Kariyawasam
			Ms.L G R C Lewangama
Internal Audit Section	JM1-2	Internal Audit Officer	Mr. S P Haputhanthri
ISC - Information Service Center	PL2	Library Attendant	G P Amarapala
	MM1-1	Assistant Librarian	Ms.W W P N Geekiyanage
	MA2-2	Library Assistant	Ms. I K Gallage
			Ms. R I P Peiris
			Ms. W M V P Weerasinghe
	JM1-2	Assistant Librarian	Ms. W W R L Fernando
		Management Officer	Ms.Y A R Kapurubandara
	HM1-3	Senior Deputy Director - ISC / Principal Research Scientist	Ms.P M Jayasinghe
	AR2	Senior Research Scientist	Ms. E M S Isanka
MBD- Marketing and Business Department	PL1	Helper	N Rukshan
	MM1-1	Senior Industrial Liaison Officer	Ms.C M Ranwala
	MA1-2	Management Assistant	Mr.M I C Perera
			Ms. M H S Surangamali
	JM1-2	Industrial Liaison Officer	Ms.M M D S Dharmasiri
		Marketing Officer	Mr.N P K Wanniarachchi
	HM1-3	Senior Deputy Director - Marketing & Business Development	Ms.N G M Wijemanne
ML- Materials Laboratory	PL2	Lab Attendant	A H A Udesh Iroshan
			G U P Pathiraja
			H Rajapaksha
			H T D M Peiris
			K P D N Kariyawasam
			M C Rodrigo
			W M M G D Wickramasinghe

	PL1	Helper	S V L Kumara
	MA2-2	Assistant Research Technologist	Mr B D M Chinthaka
			Mr L H A G K Bandara
			Ms. D D P N Jayamaha
		Assistant Research Technologist	Mr. K A Suraj
			Ms. D R A U Dasanayeke
			Ms. M M Warshahennadi
			Ms. P A R S Kumarage
			Ms. S A W Liyanage
	MA1-2	Management Assistant	Ms. P L L L Panditharathne
			Ms. W A S S Abeysekara
	JM1-2	Research Technologist	Mr. M M Niyangama
			Mr. M V P N Somathilaka
			Ms. B M P Fernando
			Ms. W A M Priyanwada
	HM1-3	Senior Deputy Director-ML/Principal Research Engineer	Mr.A A M T Adikari
	AR1	Research Engineer	Mr. R A K Kumara
			Mr.L S R Widuranga
			Ms. C N Vitharana
			Ms. P A A S Karunarathne
		Research Scientist	Mr. K K K H Amaranayake
			Ms. M V K Munasinghe
			Ms.K W Prasadini
MP&LTL- New Lab Lubricant testing	MA2-2	Assistant Research Technologist	Ms D A D I Sewwandi
			Ms K P A N Kodippili
			Ms S N Mullage
			Ms. I L D Ruwanika
			Ms. M I Mallikaratchy
			Ms. U G A Sanjeewani
	AR1	Research Scientist	Mr. W A D S V Wettasinghe
			Mr.T S E F Karunarathne
			Ms. F Z Zavahir
			Ms. K D M M Disanayaka
MPTL- New Lab Lubricant testing	MA2-2	Assistant Research Technologist	Ms H G R Dilakshi
			Ms R M L P Rathnayaka
			Ms. P A L N Perera
	MA1-2	Management Assistant	Mr. M P Dahanayaka
			Mr. W P G M T A A Indika
	AR1	Research Scientist	Mr. G A D Hasantha

MTS- Materials Technology Section	PL2	Lab Attendant	M R J Rodrigo
			P D L Priyasampath
	MA2-2	Assistant Research Technologist	Ms.H P T Wathsara
	MA1-2	Management Assistant	Ms M A T Madhushani
	JM1-2	Research Technologist	Mr. D S Samarawickrama
			Mr. R C W Arachchi
	HM2-1	Senior Deputy Director-MTS/Research Fellow	Dr(Ms)I R M Kottegoda
	AR2	Senior Research Scientist	Dr. C H Manoratne
			Dr. R C L De silva
			Mr. L D C Nayanajith
	AR1	Research Engineer	Ms. H C D P Colombage
		Research Scientist	Mr. K S P Karunadasa
			Mr.A M K L Abeykoon
			Mr.H M B I Gunathilaka
			Ms. M D Y Milani
Stores	PL2	Helper	P Murugesh
	MM1-1	Senior Stores Officer	Mr.G H K G L Kushan
	MA1-2	Management Assistant	Mr.K L S D Perera
			Ms. B K M N Rodrigo
	JM1-2	Stores Officer	Mr. A P Edirisooriya
Supplies Department	MM1-1	Senior Supplies Officer	Mr.H P R Kumara
	MA1-2	Management Assistant	Ms. H T S Nadeeshani
			Ms. S C Rupasinghe
			Ms. T D K Deheragoda
	JM1-2	Supplies Officer	Ms. W A D De Alwis
			Ms.B P N Peiris
			Ms.D L Gamalath
Transport Unit	PL3	Driver	B N S Perera
			G A S Kulatunga
			G D N Y Gamage
			G Lalith
			H S Chandraratne
			H W N D D K Jayamangala
			J S Priyantha
			K G Wickramasinghe
			N P V Kumara
			W A A Perera
	MA1-2	Management Assistant	Mr. S M T R Bandara
Finance, Section	PL1	Helper	H D C Pathirana
	MM1-1	Accounts Officer	Ms.H L D R Malavipathirana
	MA1-2	Management Assistant	Ms S D A Fernando
			Ms. L S Liyanage

			Ms. P K N Dilumnika
			Ms.I S Sewwandi
	JM1-2	Accounts Officer	Ms. H A N Perera
			Ms. L A M S P Menike
	HM1-3	Senior Deputy Director - Finance	Mr.D L C A Gunaratne
	HM1-1	Chief Accountant	Mr.D N Weerakoon
CML - Chemical and Microbiology Lab	PL3	Senior Lab Attendant	T K Gamage
	PL2	Lab Attendant	H A I Perera
			I M A P Karunaratne
			M G M Chamodya
			P D K Fernando
			P W I D Gunarathne
			V P C Danushka Jayathilake
	MM1-1	Senior Research Technologist	Mr.R N R Jayaratne
			Ms.C Vidyaratne
			Ms.H K Alahakone
			Ms.P K G De Alwis
	MA2-2	Assistant Research Technologist	Mr M S Thiwanka
			Ms H K W Sandamali
			Ms J A H Abeyrathna
			Ms M W A K Sandarenu
			Ms S V Amarasena
			Ms W R D Weerasooriya
			Ms. A H M A K Abeyrathna
			Ms. G W N T Dulshani
			Ms. H A H M Mahanama
			Ms. K K K Prematilaka
			Ms. P. M Kaluperuma
			Ms.D D D H Dewage
		Assistant Research Technologist	Mr. W A A Pieris
			Ms. D M A Peiris
			Ms. D U G Wijethilake
			Ms. M P M Pradeeplal
			Ms. O E Samarathunga
	MA1-2	Management Assistant	Ms K B Y Umangika
			Ms K Vithanage
			Ms. D D I D Senaratne
			Ms. D P C Gunasekara
	JM1-2	Research Technologist	Mr. V J Chitran
			Mr.H M K Pathirana
			Mr.M M C B Nawarathna

			Mr.S P Hettiarachchi
			Ms. A A N U Amarasinghe
			Ms. A L S Malwenna
			Ms. K R M Gunaratne
	HM2-1	Senior Deputy Director - C&ML/Research Fellow/ADG TEC Serv (Cover up)	Dr.H P P S Somasiri
	ARI	Research Scientist	Ms.D.M.D.M. Disanayaka
	AR2	Senior Research Scientist	Dr (Ms) W D K Mahatantila
			Mr. K S Weerakkody
			Ms. S H S Karunaratne
	AR1	Research Scientist	Dr(Ms) W C Prasadani
			Mr D R C Perera
			Ms. H P E De Zoysa
			Ms. M R P Dasanayake
			Ms. P S F Perera
			Ms. R A P S De Alwis
			Ms. S I Weerasekara
			Ms. S K Liyanage
			Ms.T G Vithanage
ETL - Electrotechnology Laboratory	PL3	Electrician	G R A Samarasekara
	PL1	Helper	L N B Fernando
	MM1-1	Senior Research Technologist	Mr.W L D D C Jayaratne
	MA2-2	Assistant Research Technologist	Mr P D Buddhika
			Mr. H K M Perera
		Assistant Research Technologist	Mr. A M A P N Alagiyawanna
	JM1-2	Research Technologist	Mr. K K N Dharshana
	HM1-3	Senior Deputy Director - ETL/Principal Research Engineer	Dr.R M Weerasinghe
	AR2	Senior Research Scientist	Mr. C M Kalansooriya
	AR1	Research Engineer	Mr. R P K Wijewardena
			Mr. S D T L Kumara
		Research Scientist	Mr. K A C Perera
			Mr. K D U H Abeywickrama
QAD- Quality Assurance Department	MA1-2	Management Assistant	Ms. K L Nisansala
	HM1-3	Senior Deputy Director- QAD/Principal Research Scientist	Ms.W A J Sajeewika
	AR1	Quality Assurance Officer	Ms.P M A P Marage

		Research Scientist	Ms. F H Salahudeen
			Ms. H G T H Jayathunga
RAL- Residue Analysis Laboratory	PL2	Lab Attendant	M D P W Kumara
	PL1	Helper	P S Kumara
	MM1-1	Senior Research Technologist	Mr.H A A Perera
	MA2-2	Assistant Research Technologist	Mr M L R Chathuranga
			Ms S M N R K Seneviratne
			Ms. D K S D Piyathissa
			Ms. N B Hettiarachchi
			Ms. W K N D Dias
		Assistant Research Technologist	Ms. R A D S M R Weerasekara
	MA1-2	Management Assistant	Ms. N N Amarasekara
	JM1-2	Research Technologist	Ms. K D S M Karunarathne
	HM1-3	Senior Deputy Director - RAL / Principal Research Scientist	Mr.M N A Mubarak
	AR1	Research Scientist	Ms A U W Dissanayake
			Ms K D Madhushani
			Ms. D A T W K Dissanayake
			Ms. G U Chandrasiri
			Ms. G V V Liyanaarachchi

Annex 2 – Funded Projects.

Table 56: Funded Projects Detail

Years	Years2	Duration	Project Title	Funding Source	Sum of Fund Rs. Million
2013	2018	60	Investigation on natural fragrances and other volatiles from Sri Lanka flora and their industrial applications	TG	3.20
2014	2017	37	Cloning thermostable alpha amylase gene into Pichia pastoris and optimization of large scale thermostable alpha amylase enzyme production using a fermenter	TG	0.61
2015	2017	19	Isolation, identification & characterization of potentially probiotic lactic acid bacteria of dairy origin in Sri Lanka for future application as probiotic starters	TG	1.53
2015	2017	25	Evaluation of Cinnamomum zeylancium (Ceylon cinnamon) as a potential pharmaceutical agent for diabetes Mellitus	TG	1.65
2015	2018	39	Enhanced preservation of fruits using nanotechnology	IDRC, Canada	54.64
2015	2019	49	Microbial bioremediation of petroleum hydrocarbon contaminated soil & water	TG	2.50
2015	2019	59	Capacity building for the development of monoclonal antibodies against Dengue virus and to determine the feasibility of a nanomaterial to anchor the developed antibodies	TG	4.40
2016	2017	19	Development of a molecular based assay differentiate Thunnus obesus (Bigeye tuna) and Thunnus albacares (Yellow fin tuna)	TG	0.50
2016	2018	25	Determination of mycotoxins and fungal spore contamination in tea brew at the time of consumption	TG	2.00
2016	2018	30	Development of shelf stable high energy instant food products from locally available raw materials using gamma irradiation	TG	1.00
2016	2018	30	Evaluation of bioactive properties of Sri Lankan finger millet and determination of in vitro cholesterol assimilation effect of potential probiotics isolated from finger millet	TG	1.80
2016	2018	31	Development of a diagnostic kit for the detection of anti-rabies antibodies in serum samples after post-exposure of rabies vaccination in humans	TG	0.80
2016	2019	37	Development of molecular based testing for Genetically Modified (GM) food items and diagnostic tests for food borne pathogens	TG	3.40

2016	2019	37	Development of Red-clay based water filter/apparatus for the removal of hardness of drinking water	TG	1.00
2016	2019	37	Development of technologies for sustainable raw material production for cosmetic industry using endemic Gyrinops walla gaertn (Sin. Walla Patta) – an endemic, industrial potential, lucrative fragrance plant grown in Sri Lanka	TG	4.74
2016	2019	37	Rapid determination of coconut oil authenticity and quality with NIR spectroscopy	TG	2.50
2016	2019	37	Rapid extraction of medicinal & aromatic plants and flowers & selective isolation of compounds by microwaves	TG	2.00
2016	2019	37	Reduction of vehicle exhaust emissions by nanoparticle supported adsorption media	TG	2.00
2016	2019	42	Biodiversity and Technological Potential of Micro-flora from Selected Sri Lankan Dairies	NSF	2.00
2016	2020	46	Degradation kinetics of Glyphosphate residues, metabolites and additives in conventional fields of application and simulated environments	TG	2.49
2017	2018	18	Development of in-vitro propagation technology for commercial cultivation of Stevia rebaudiana Bertoni (Asteraceae) - A non-caloric, natural sweetener	TG	0.90
2017	2019	21	Method development, validation and market survey of pesticide residues in tea and spices using LC-MS-MS.	TG	1.50
2017	2019	25	Determination of Cyanotoxins in surface waters of Sri Lanka	TG	2.00
2018	2019	13	Acoustic environment induced by background noise in classrooms of urban schools in Sri Lanka	TG	0.30
2018	2019	18	Establishment of biologically relevant antioxidant bioassays covering different mode of actions: applications in R&D and commercialization.	TG	1.50
2018	2019	18	The evaluation of impacts of Agrochemicals on Grape tree cultivating soil and water; study of heavy metals, nitrates and phosphates.	TG	1.00
2018	2019	22	Technological optimization and shelf life studies of processed and refrigerated coffee milk beverage	TG	0.25
Grand Total					102.21.

Table with project duration in ascending order

Table 57: Project Duration in Ascending Order of Projects

Duration Months	Project Title	Sum of Funds Rs.Mil

13	Acoustic environment induced by background noise in classrooms of urban schools in Sri Lanka	0.30
18	Development of in-vitro propagation technology for commercial cultivation of Stevia rebaudiana Bertoni (Asteraceae) - A non-caloric, natural sweetener	0.90
	Establishment of biologically relevant antioxidant bioassays covering different mode of actions: applications in R&D and commercialization.	1.50
	The evaluation of impacts of Agrochemicals on Grape tree cultivating soil and water; study of heavy metals, nitrates and phosphates.	1.00
19	Development of a molecular based assay differentiate Thunnus obesus (Bigeye tuna) and Thunnus albacares (Yellow fin tuna)	0.50
	Isolation, identification & characterization of potentially probiotic lactic acid bacteria of dairy origin in Sri Lanka for future application as probiotic starters	1.53
21	Method development, validation and market survey of pesticide residues in tea and spices using LC-MS-MS.	1.50
22	Technological optimization and shelf life studies of processed and refrigerated coffee milk beverage	0.25
25	Determination of Cyanotoxins in surface waters of Sri Lanka	2.00
	Determination of mycotoxins and fungal spore contamination in tea brew at the time of consumption	2.00
	Evaluation of Cinnamomum zeylancium (Ceylon cinnamon) as a potential pharmaceutical agent for diabetes Mellitus	1.65
30	Development of shelf stable high energy instant food products from locally available raw materials using gamma irradiation	1.00
	Evaluation of bioactive properties of Sri Lankan finger millet and determination of in vitro cholesterol assimilation effect of potential probiotics isolated from finger millet	1.80
31	Development of a diagnostic kit for the detection of anti-rabies antibodies in serum samples after post-exposure of rabies vaccination in humans	0.80
37	Cloning thermostable alpha amylase gene into Pichia pastoris and optimization of large scale thermostable alpha amylase enzyme production using a fermenter	0.61
	Development of molecular based testing for Genetically Modified (GM) food items and diagnostic tests for food borne pathogens	3.40
	Development of Red-clay based water filter/apparatus for the removal of hardness of drinking water	1.00
	Development of technologies for sustainable raw material production for cosmetic industry using endemic Gyrinops walla gaertn (Sin. Walla Patta) – an endemic, industrial potential, lucrative fragrance plant grown in Sri Lanka	4.74
	Rapid determination of coconut oil authenticity and quality with NIR spectroscopy	2.50
	Rapid extraction of medicinal & aromatic plants and flowers & selective isolation of compounds by microwaves	2.00
	Reduction of vehicle exhaust emissions by nanoparticle supported adsorption media	2.00
39	Enhanced preservation of fruits using nanotechnology	54.64
42	Biodiversity and Technological Potential of Micro-flora from Selected Sri Lankan Dairies	2.00

46	Degradation kinetics of Glyphosphate residues, metabolites and additives in conventional fields of application and simulated environments	2.49
49	Microbial bioremediation of petroleum hydrocarbon contaminated soil & water	2.50
59	Capacity building for the development of monoclonal antibodies against Dengue virus and to determine the feasibility of a nanomaterial to anchor the developed antibodies	4.40
60	Investigation on natural fragrances and other volatiles from Sri Lanka flora and their industrial applications	3.20
Total		102.21

Annex 3 - Completed and Ongoing Projects

Table 58: Completed Projects with the Year of Completion	
2017	Cloning thermostable alpha amylase gene into Pichia pastoris and optimization of large scale thermostable alpha amylase enzyme production using a fermenter (May- 2014 - May- 2017)
	Developing of a DNA rabies vaccine for dogs (Jul- 2013 - Jun- 2017)
	Development of a molecular based assay differentiate Thunnus obesus (Bigeye tuna) and Thunnus albacares (Yellow fin tuna) (Apr- 2016 - Oct- 2017)
	Evaluation of Cinnamomum zeylancium (Ceylon cinnamon) as a potential pharmaceutical agent for diabetes Mellitu (Aug- 2015 - Aug- 2017)
	Identification of chemical fraction of TragiainvolucrataL and the effect on hyperglycaemic subjects (Dec- 2014 - Dec- 2017)
	Isolation, identification & characterization of potentially probiotic lactic acid bacteria of dairy origin in Sri Lanka for future application as probiotic starters (Jul- 2015 to Jan- 2017)
	Photo-catalytic technology for purification of agro-chemical contaminated wastewater from agro-chemical packaging and formulation industries (Jul- 2013 - Jun- 2017)
	Study of Poly Aromatic Hydrocarbons (PAH) in selected firewood smoke & development of a cottage level food smoker (Aug- 2015 - Aug- 2017)
	Testing of heat pump dryer for perishables & cereal dehydration (Sep- 2015 - Aug- 2017)
2018	Control of air pollution from cast iron foundries in Malabe area (Jan- 2018 - Dec- 2018)
	Determination of mycotoxins and fungal spore contamination in tea brew at the time of consumption (May- 2016 - May- 2018)
	Developing a humidity & temperature data acquisition & monitoring system for Industrial Metrology Laboratories (Feb- 2015 - Feb- 2018).
	Development of an anti-glycation and glycation reversing assay kit addressing all stages of glycation process (Jul- 2016 - Jan- 2018)
	Development of a diagnostic kit for the detection of anti-rabies antibodies in serum samples after post-exposure of rabies vaccination in humans (Apr- 2016 - Oct- 2018)
	Development of in-vitro propagation technology for commercial cultivation of Stevia rebaudiana Bertoni (Asteraceae) -A non-caloric, natural sweetener (Jan- 2017 - Jun- 2018)
	Development of shelf stable high energy instant food products from locally available raw materials using gamma irradiation (Apr- 2016 - Sep- 2018)
	Enhanced preservation of fruits using nanotechnology (CIFSRF Phase 2) (Jan- 2015 - Mar- 2018)

	Evaluation of bioactive properties of Sri Lankan Finger millet and determination of in-vitro cholesterol assimilation effect of potential probiotics isolated from Finger millet (May- 2016 - Nov- 2018)
	Investigation of Sri Lankan natural compounds as drug leads for inflammatory diseases and management of dyslipidemia: in-silico and in-vitro approach (Dec- 2016 - Dec- 2018)
	Investigation on natural fragrances and other volatiles from Sri Lanka flora and their industrial applications (Jul- 2013 - Jun- 2018)
	Study on effect of processing parameters on the functionality of rice bran oil from local rice varieties and development of an appropriate bran oil extraction technique for SMEs (Mar- 2015 - Mar- 2018)
	Use of micro-remediation technique for the treatment of wastewater contaminated with pesticides (Mar- 2015 - Mar- 2018)
	Value addition to coconut oil (May- 2016 - May- 2018)
2019	Acoustic environment induced by background noise in classrooms of urban schools in Sri Lanka (Jan- 2018 - Jan- 2019).
	Antioxidant and enzyme inhibitory phytoceuticals for cosmetic applications (May- 2017 - May- 2019).
	Assessment of frying conditions on safety and quality aspects of food (Jan- 2018 - Sept- 2019).
	Biodiversity and technological potential of micro-flora from Sri Lankan dairies (May- 2016 - Jun- 2019).
	Capacity building for the development of monoclonal antibodies against Dengue virus and to determine the feasibility of a nanomaterial to anchor the developed antibodies (Feb- 2015 - Dec- 2019).
	Comprehensive research proposal on an operational model to control dengue in Sri Lanka using multiple vector control Intervention, new product development and community engagement (Jan- 2015 - Aug- 2019).
	Determination of Cyanotoxins in surface waters of Sri Lanka (Dec- 2017 - Dec- 2019).
	Development of Bacillus thuringiensis (Bt) microbial pesticide to control rice pests (Jul- 2016 - Jul- 2019).
	Development of molecular based testing for Genetically Modified (GM) food items and diagnostic tests for food borne pathogens (Mar- 2016 - Jun- 2019).
	Development of Red-clay based water filter/apparatus for the removal of hardness of drinking water (May- 2016 - May- 2019)
	Development of technologies for sustainable raw material production for cosmetic industry using endemic Gyrinopswallagaertn (Sin. Walla Patta) – an endemic, industrial potential, lucrative fragrance plant grown in Sri Lanka (Jun- 2016 - Jun- 2019).
	Establishment of biologically relevant antioxidant bioassays covering different mode of actions: applications in R&D and commercialization (Jan- 2018 - Jun- 2019).
	Extraction, isolation and formulation of plant protection products (PPP) from local medicinal plants for the management of sucking pests of fruits, vegetables and ornamental plants (Jan. 2017 - Jan. 2019).
	Further work on production of high quality graphene based materials from local graphite for high-tech application (Oct- 2016 - Dec- 2019).
	Market basket survey to analyze pesticide residue levels in vegetables, fruits and leafy vegetables in Sri Lanka. (Second Phase) (Dec- 2017 - Dec- 2019).

	Method development, validation and market survey of pesticide residues in tea and spices using LS-MS-MS (Dec- 2017 - Aug- 2019).
	Microbial bioremediation of petroleum hydrocarbon contaminated soil and water (Mar-2015 - Mar-2019)
	Molecular and Biochemical characterization of Bacillus thuringiensis isolates with insecticidal activity (Jun- 2017 - Mar- 2019)
	Rapid determination of coconut oil authenticity and quality with NIR spectroscopy (Nov-2016 - Nov- 2019).
	Rapid extraction of medicinal & aromatic plants and flowers & selective isolation of compounds by microwaves (Feb- 2016 - Feb- 2019).
	Reduction of vehicle exhaust emissions by nanoparticle supported adsorption media (May-2016 - May- 2019)
	Studies in Surface sterilization of spices using non-thermal process (Oct- 2017 - Oct- 2019).
	Technological optimization and shelf life studies of processed and refrigerated coffee-milk beverage (Mar- 2018 - Sept- 2019).
	The evaluation of impacts of Agrochemicals on Grape tree cultivating soil and water; study of heavy metals, nitrates and phosphates (Jan- 2018 - Jun- 2019).
	Validation of AERMOD View and CALPUFF View Air Dispersion models on stationary source emissions considering thermal power plants (Apr- 2016 - Apr- 2019)
Table 59: Ongoing Projects with the Year of Commencement	
2017	Amino acid profiling of selected Sri Lankan rice varieties using liquid chromatographic techniques (Dec- 2017 - Jun- 2020).
	Conversion of readily available Sri Lankan natural quartz to solar grade silicon for applications in electronic industries (May- 2016 - May- 2020).
	Degradation kinetics of Glyphosphate residues, metabolites and additives in conventional fields of application and simulated environments (Apr- 2016 - Jan- 2020).
	Developing a wireless humidity and temperature monitoring system to calibrate industrial humidity and temperature recorders (Dec- 2017 - Jun- 2020).
	Screening and assessment of Lactic Acid Bacteria from Sri Lankan dairies (under TG 15/117) as source of functional ingredients for the industry (Dec- 2017 - Jun- 2020).
	Studies on microflora in different types of tea produced in three different elevations in Sri Lanka (Nov- 2015 - Nov- 2020).
	Trace elements (toxic and essential) content in selected rice varieties available in the Sri Lankan market and study on the effect of essential trace elements on uptake of toxic elements by rice in simulated environment (Dec- 2017 - Dec- 2020).
2018	Application of anaerobic digestion for the treatment of Poultry processing wastewater and determination of CH4and CO2 emission factors (Jan- 2018 - Jan- 2021).
	Baseline study on nutritional status of selected commonly consumed food items in Sri Lankan market with special reference to trans-fat status, ώ6:ώ3 (Jan- 2018 - Jan- 2020).
	Comprehensive utilization of Sri Lankan grown of Moringaoleifera in developing health food and herbal medicinal products to startup Moringaoleifera industry in Sri Lanka (Mar-2018 - Mar- 2021).
	Curing of bamboo culm that suit to tropical environment and bamboo products development (Jan- 2018 - Jan- 2021).
	Design and development of standard AC-DC current shunt (May- 2018 - May- 2021).
	Development of data base on nutritional, chemical, molecular and morphological characteristics of selected traditional and widely consuming improved rice varieties of Sri

	Lanka: Suitability to use as chemical and molecular fingerprints in identifying rice varieties at grain level (Jul- 2018 - Jul- 2021).
	Development of instant nutritional porridge as a supplementary food for the patients with diabetic mellitus and cholesterol (Jan- 2018 - Jan- 2020).
	Development of live noise barrier blocks for outdoor sound proofing (Jan- 2018 - Feb- 2020).
	Enhancement of acid rain monitoring station (Jan- 2018 - Jan- 2020).
	Improvement of thermal conductivity of rubber using graphite based nanocomposite as a value addition (Jan- 2018 - Jan- 2020).
	Investigation of Calcium Magnesium and heavy metal uptake efficiency of Terminalia arjuna(Kumbuk tree) as a phyto-remediation species for water quality improvement of CKDU affected areas (Feb- 2018 - Feb- 2020).
	Low cost, ecofriendly domestic system to compost bio-degradable food waste (Jan- 2018 - Jan- 2020).
	Pharmacognostical investigation of Curcuma albifloraThw. (Harankaha) (Feb- 2018 - Feb- 2020).
	Screening of Anti-Nutritional factors (ANFs) and activity of bio active proteins in locally grown edible legume varieties (Jan- 2018 - Jan- 2020).
	Streamline the PECMA PT scheme in microbiological area (Sept- 2018 - Sept- 2020)
	Study on the use of sugar substitutes for food products, their detection and the development of low calorie foods (Mar- 2018 - Mar- 2020).
	Value addition to essential oils by fractional distillation under vacuum (Feb- 2018 - Feb- 2021).
2019	Assessment of claims on intense accumulation of heavy metals; Hg in Puttalam lagoon followed by potential health implications and industrial contributions (Jul- 2019 - Jul- 2022).
	Chemical residues in bovine milk produced by medium and large scale dairy farms and their public health concern in Sri Lanka (Jul- 2019 - Jul- 2022).
	Design of production process equipment and wastewater treatment plant for Graphene production process (Sept- 2019 - Mar- 2021).
	Determination of noise level and acoustic analysis of toys for children (Jul- 2019 - Apr- 2021).
	Development and characterization of a certified reference material for nutrients, micronutrients and heavy metals from Sri Lankan traditional rice varieties for method validation and QA/QC activities (Sept- 2019 - Sept- 2022).
	Development and scaling up of technologies of value added products from selected underutilized fruits and investigation of their functional properties (Aug- 2019 - Aug- 2021).
	Development of a plant based fungicide formulation to control anthracnose disease of mango and papaya (Jul- 2019 - Jul- 2021).
	Development of a polylactic acid (PLA) based low cost biodegradable plastic film as a replacement for polythene shopping bag and "Lunch Sheet" (Sept- 2019 - Sept- 2021).
	Development of an adulteration detection kit for bee honey for industries (Jul- 2019 - Jul- 2020).
	Development of inhouse multiplex real time PCR based methods for food testing (detection of GM food, food/water borne pathogens and meat adulteration in meat products) (Jul- 2019 - Jul- 2022).
	Development of lubricant products from local graphite (Jul- 2019 - Jul- 2021).

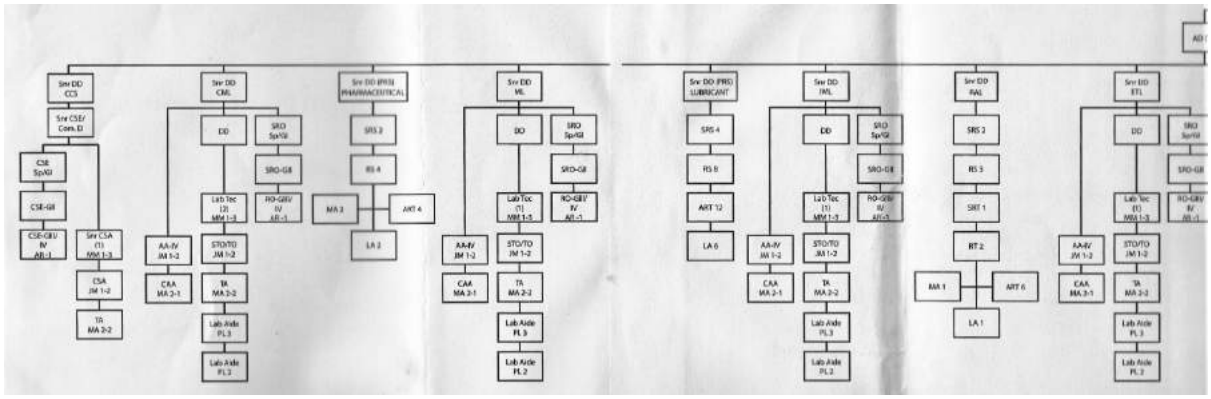
	Development of new value-added health products incorporating underutilized bioactive medicinal plants to address lifestyle diseases in Sri Lanka (Aug- 2019 - Aug- 2022).
	Development of technologies to utilize waste whey in local dairy bio processing industries for the production of value added/functional beverages (Oct- 2019 - Oct- 2022).
	Establishment of a facility for thermal process validation of canned food and low moisture processed food operations in Sri Lanka (Jul- 2019 - Jul- 2021).
	Fabrication of low cost graphite- based composite electrode for electro-chemical applications (at high temperature) as a value addition to local minerals (Jun- 2019 - Jun- 2021).
	Implementing standard operational procedures (SOP) for Cell Culture Lab through Bio safety Measures, Capacity Building and Development of in vitro Applications (Jun- 2019 - Jun- 2021).
	Investigation of endemic Ceylon cinnamon for its physico-chemical parameters, some bioactivity studies and DNA barcoding (Jul- 2019 - Jul- 2021).
	Pharmacognostical, chemical characterization and selected bioactive properties of Canariumzeylanicum and development of value added products (Jul- 2019 - Jul- 2022).
	Quality Assurance and risk assessment in commercially available cosmetics products in Sri Lanka (Aug- 2019 - Aug- 2022).
	Rapid determination of virgin coconut oil authenticity and quality with -phase II (Sept- 2019 - Sept- 2022).
	Selected chemical, nutritional and functional health benefits of Sri Wijeya and Sri Gemunu high yielding cinnamon varieties (Cinnamomumzeylanicum Blume) developed in Sri Lanka (Jul- 2019 - Jul- 2021).
	Spray drying of selected fruits, vegetable juices and yam pulps and innovative spray dried powder based product development (Aug- 2019 - Aug- 2022).
	Study on microbiological physicochemical characteristics and mycotoxin contamination in commonly consumed edible oils in Sri Lanka (Jun- 2019 - Jun- 2022).
	Study the distribution and quantification of microplastics and the accompanied pollutant assemblages in the aquatic environments in Sri Lanka (Jul- 2019 - Jul- 2022).

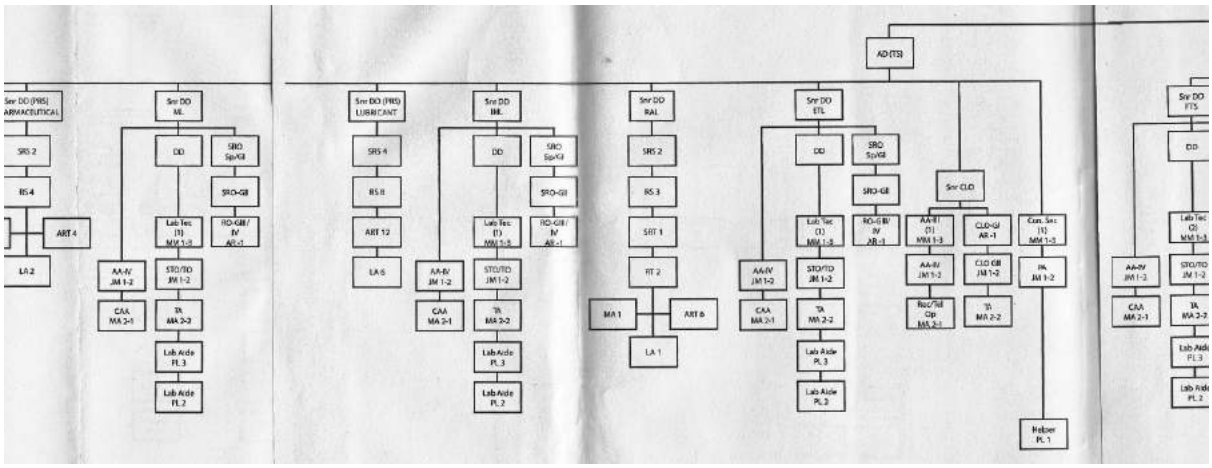
.

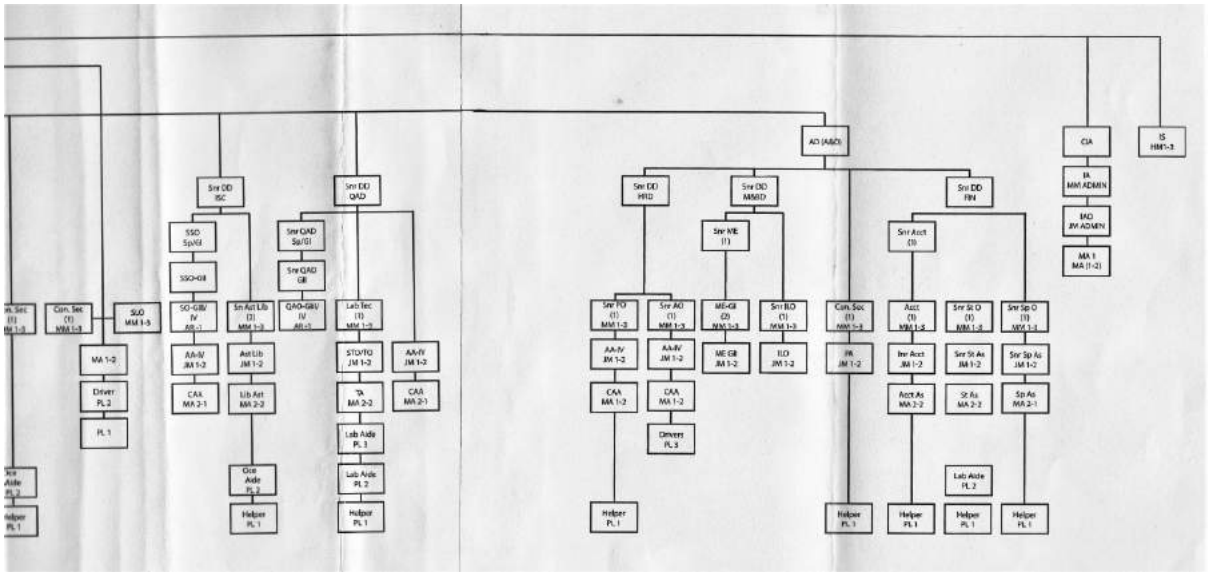
.

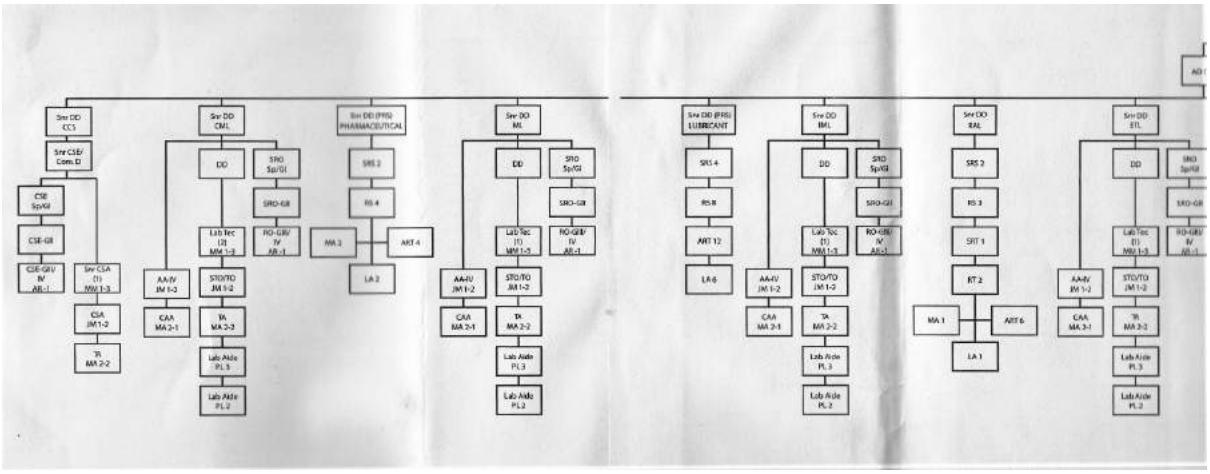
Annex 4 - Organization Divisions and Departments & Sections.

(We can provide a larger version but the figures are rationalized here)









Annex 5 – Review Teams Visits to ITI and Zoom Meetings

Annex 5.1 – Face to Face Meetings with Officers of ITI Conducted for the Review

Table 60: Review Team's Visits and Meetings

Date of Visit	Time	Visited Location	The officers Interviewed/ Laboratories visited
09/10/2020	10.00 am -6.00 pm	ITI- Malabe	Dr.(Ms) J.K.R.Radhika Samarasekera Director General
19/10/2020	10.00 am- 11.30 am	ITI -Malabe	Dr. Ilmi G.N Hewajulige Additional Director General – Research & Development
	11.30- am - 1.00 pm		Mr. K.A.S.P. Kaluarachchi Additional Director General – Administration & Operation and Senior Deputy Director– Administration and Human Resource (Covering)
	2.00- 2.45 pm		Dr. P. Ranasinghe Senior Deputy Director – Herbal Technology Section
	2,45pm - 4.00 pm		Lab visit – Food Technology Section with Dr. Ilmi G.N Hewajulige Visited the following labs. Plant pathology lab Post-harvest Technology lab Cereal technology laboratory Fruit & Vegetable processing lab Sensory & shelf-life testing lab Food analysis lab Fish processing lab Nutrition & Functional Food lab Chemical analysis lab
20/10/2020	9.30 am- 1.30 pm	ITI-Malabe	Mr. D L C A Gunaratne Senior Deputy Director Finance
	2.30m-4.00 pm		Herbal section laboratory visit with Dr.Ranasinghe.

			In the herbal section following Labs were visited, Bio activity laboratory Organic laboratory III Essential oil laboratory Organic laboratory
15/12/2020	9.00 am – 10.30 am	ITI- Bauddhaloka Mawatha & Vidya Mawatha Colombo-07	Meeting with Dr. Ilmi G.N Hewajulige (ADG-R&D) & Dr H.P.P.Sudarshana Somasiri (ADG-TEC Serv)
	10.30 am -4.00 pm		Laboratory Visits with Dr. H.P.P.Sudarshana Somasiri Following Laboratories were visited, Chemical & Microbiology Section Residue Analysis Laboratory Cosmetics & Pharmaceutical Analysis Laboratory Vitamin Laboratory Water & Inorganic Residue Analysis Laboratory Wastewater Laboratory Food & fertilizer Laboratory Material Laboratory Paint Testing Laboratory Paper & Packaging Testing Laboratory Cement Testing Laboratory Metal Testing Laboratory Industrial Metrology Laboratory Volume & Density laboratory Temperature & Humidity Testing Laboratory Dimensional Laboratory Mass Laboratory Electrical Laboratory Pressure Laboratory
16/12/2020	9.00 am – 12.00 pm	ITI- Bauddhaloka Mawatha & Vidya Mawatha Colombo-07	Laboratory Visits with Dr. Ilmi G.N Hewajulige (ADG R&D) Following Laboratories were visited, Environmental Technology Section R&D Material Technology Section R&D

			Biotechnology Unit R&D Information Services Center (Library) Engineering Services Unit
	12.00 12.30 pm		IT Section Dr. Ruwan Weerasinghe (Senior Deputy Director- Covering)
	1.30-4.00 pm		Meeting with Dr.(Ms) J.K.R.Radhika Samarasekera Director General
21/12/2020	12.00 pm-4.00 pm	ITI- Malabe	Dr. C. Embuldeniya Meet officers at Finance, DDG, DG
22/12/2020	12.30 pm-1.00 pm	ITI- Malabe	Discussion with Dr G A S Premakumara Chairman
	1.00 pm- 2.00 pm		Zoom Meeting with Board Members. Following Board members were participated in the Zoom Meeting. Dr. G A S Premakumara – chairman, ITI Dr.(Ms) J.K.R.Radhika Samarasekera. Director General, ITI Ms Deepa Liyanage Additional Secretary (Research) Ministry of Higher Education , Technology & Research Prof. Athula Perera Emeritus Professor Mr Dinesh Kumara Founder Inspire X Pvt. Ltd./ Founder Niwadu Deals Pvt. Ltd Dr Aruna Champika Jayakody. Executive Director, Melsta Hospital, Ragama Ms. Kumudunie Chandrasekara. Assistant Director, Department of External Resources, Ministry of finance Mr. W.H.S.Priyantha vithnage Consultant Civil engineer

Annex 5.2 - Zoom Meetings with Officers of ITI Conducted for the Review

Table 61: Zoom Meetings Conducted for the Review

Date	Time	Officers Interviewed	Section	Post
27/10/2020	1.00-2.00 pm	Dr. Chandima Wijesiriwardana	HTS	Fellow Scientist
	2.00 pm-2.30 pm	Dr. Selvaluxmy	HTS	Principal Research Scientist
		Dr.Nevil Amunugoda	HTS	Principal Research Scientist
	2.30 pm - 3.00 pm	Dr. Menuka Arawawela-HTS	HTS	Principal Research Scientist
		Dr Theja Herath	FTS	Principal Research Scientist
	3.00 pm – 3.30pm	Mr.Hasitha Weeratunge	HTS	Senior Research Scientist
		Ms.Upeka Rajakaruna	FTS	Senior Research Scientist
28/10/2020	9.00 am to 10.15 am	Mr. Samantha	Food Lab	Junior Research scientist
		Ms. Wasundara	Food Microbiology lab	Junior Research scientist
		Mr.Tharaka	Food Lab	Research Scientist
		Ms. Gayathri	Food Technology Section	Research Engineer
	1.00 pm – 3.00 pm Technical officers Malabe	Ms. Shiranthi	pathology & Post harvesting labs	Senior Research Technologist
		Ms. Pushpa	Herbal Technology section	Senior Research Technologist
		Ms. Dineshika	Food Technology	Research Technologist

			section-Cereal Technology lab	
		Dilini Jayawardana	Food Technology Section	Research Technologist
02/11/2020	9.00 am – 9.45 am	Mr. Anura Sooriyaarachchi	Engineering Services Division	Chief Engineer
	9.45 am - 10.30 am	Ms. Manori Wijemanna	Marketing & Business Development Department	Senior Deputy Director Marketing & Business Development
	10.30 am – 11.15 noon	Ms. W A J Sajeevika Perera	Quality Assurance Department,	Senior Deputy Director
	11.15 am - 12.00 noon	Mr. Anura Sooriyaarachchi	Engineering Services , Transport Unit	Chief Engineer
04/11/2020	9.30 am – 10.30 am	Dr H P P S Somasiri	Chemical & Microbiology Laboratory,	Additional Director General- Technical Services (covering) and Senior Deputy Director /Chemical & Microbiology Laboratory,
	10.30 am – 12.00 noon	, Mr. M N A Mubarak	Residual Analysis Laboratory	Senior Deputy Director
05/11/2020	9.00 am – 10.00 am	Dr. Ruwan weerasinghe	Electro Technology Laboratory	Senior Deputy Director
	10.00 am – 11.00 noon	Dr. Wijesinghe	Industrial Metrology Laboratory	Senior Deputy Director
10/11/2020	1.00-200 pm	Dr. Iresha Kottegoda,	Material Technology Section	Senior Deputy Director
	2.00 – 3.00 pm	Mr. Adikari	Material laboratory Technical services	Senior Deputy Director
	3.00-4.00 pm	Mr. sanath Haputhanthri	Internal Audit Section	internal Auditor-Management Assistant
12/11/ 2020	1.00pm – 2.00 pm	Mr. Thilak Gunasekara	Enviorenmental Technology Section	Senoir Deputy Director

	2.,00 pm-3.00 pm	Ms. Purnima .M. Jayasinghe	Information Services Centre (Library)	Senior Deputy Director
	4.00 – 5.00 pm	Dr. R.M Dharmadasa	Biotechnology Unit	Senior Deputy Director
17/11/2020	1.00 - 2.00 pm	Dr. Ruwan M, weerasinghe	Computer & communication Section	Senior Deputy Director (Acting)
	2.00 pm - 2.30 pm	Mr. Kamal Weerakkodi	Environmental lab	Senior Research Scientist
	2.30 pm – 315 pm	Ms.Himashi Karunarathna	Microbiology lab	Senior Research Scientist
	3.15 pm – 4.00 pm	Dr, Ms. W.D,K Mahathanthila	water lab	Senior Research Scientist
24/11/2020	1.00pm - 1.30 pm	Ms. Ruvini Dassanayake	Cosmetic & oil lab. In CML (Chemical & Microbiology Lab)	Research Scientist
	1.30 pm-2.00 pm	Ms. S.K Liyanage	Water & Wastewater Laboratory in CML	Research Scientist
	2.00 pm - 2.30 pm	Ms. P.S.F. Perera	Food & Agro Laboratory in CML	Research Scientist
	2.30 pm-3.00 pm	Ms. H.P.E de Soysa	Food & Agro Lab in CML	Research Scientist
	3.00 pm-3.30pm	Mr. Deshan Perera	Air Quality Laboratory	Research Scientist
27/11/2020	1.00pm - 1.30 pm	Mr. R.N.R Jayarathne	Air Quality Section	Senior Research Technologist
30/11/2020	1.00 pm-2.30 pm	Ms. K Roshitha M Gunaratne.	Food & Agro Lab in CML	Research Technologist
		Ms.H K Alahakoon	Food Lab in CML	Senior Research Technologist
		Ms. A L Sumudu Malwenna	Cosmetic, Fats & oil lab.	Research Technologist
		Mr. V . Jayan Chitran	Food & Agro Lab in CML	Research Technologist
		Ms. Manojee	Microbiology Lab	Research Technologist
01/12/2020	1.00pm-2.00 pm	Mr. Roshan	Inorganic Residue Analysis lab	Technical Assistant

		S.M.R Weerasekara	Organic Residue Analysis lab	Assistant Research Technologist
		Ms. D.K.S.D Piyatissa	Organic Residue Analysis lab	Assistant Research Technologist
	2.oo pm – 4.00pm	Ms. D.A.T.W.K Dissanayake (Ms. Thanuja Dissanayake)	Organic Residue Analysis lab	Research Scientist
		Ms. Vimarshi Liyanarachchi	Organic Residue Analysis lab	Research Scientist
		Mr. H.M.B Induwan Gunathilake	Material Technology Section	Research Scientist

Annex 5.3 - Zoom Meetings with Customers of ITI Conducted for the Review

Date	**Time**	**Name of the Stakeholder**		**Person Interviewed**
05/01/2021	1.00pm – 4.30pm	1	Ceyquartz MBI (Pvt) Ltd	Ms. Niluka Abegunawardane
		2	Jafferjee Brothers	Mr. Samitha Karunarathna
		3	Built-Mech Services (Pvt) Ltd	Mr. Niranja Pathirana
		4	Sinohydro (SL) Kaluganga Reservoir Headworks Project	Mr. Wickramarachchi (Engineer)
		5	BGN Industrial Tyre (Pvt) Ltd	Mr. Wipul Gunawardane (Operation Manager)
		6	Barbara Sansoni Exports (Pvt) Ltd	Ms. Mithila Samaraweera
		7	Maleena Distributors	Mr. Hasitha Malik
		8	BND Consultants	Mr. Duminda Sumaweera Country Manager
		9	Mr. K.P Somadasa & company	Ms. Rukshani Perera
		10	CNR Construction Tech. (pvt) Ltd.	Mr. R,G Wimalasena
08/01/2021	9.30 am- 1.00 pm	1	Lanka Canneries	Mr. Nilan Ekanayake
		2	Tokyo Cement Company	Mr. Thirumal Ms. Tharushika

		3	Nalanadavi (pvt) ltd.	Mr. Dhishan Malaka Samarasinghe Lead Operation Engineer- Kerawalapituiya power plant
		4	Global Surgical Products Limited	-
		5	Sun Shine Tea (pvt) Limited	Ms. Kanthi
		6	Sri Lanka Tea Board	Mr. Bandula Jayamanna
		7	Sino Hydro Corporation Ltd. (Kaluganga Reservoir Head work Project)	Mr, Fazil Engineer
		8	Water mart Systems (Pvt) limited	Mr. Ishara Vithana (Microbiology degree India M.Sc. Auckland)

Annex 5.4 - Zoom Meetings held within Evaluation Team.

(there were other conference calls but not recorded)

Date	Time	Members Participated
05/12/2020	1.30pm-4.30pm	Dr. Chandra Embuldeniya Prof. Priyani Paranagama Ms. Sakunthala Tennakoon
25/12/2020	4.00-6.00pm	Prof. Priyani Paranagama Ms. Sakunthala Tennakoon
27/12/2020	4.00-5.30 pm	Prof. Priyani Paranagama Ms. Sakunthala Tennakoon Dr. Ilmi G.N Hewajulige *
16/01/2021	3.15-4.45pm	Prof. Priyani Paranagama Ms. Sakunthala Tennakoon
21/01/2021	5.00pm-7.30 pm	Dr. Chandra Embuldeniya Prof. Priyani Paranagama Ms. Sakunthala Tennakoon
24/01/2021	5.00 pm-7.30 pm	Dr. Chandra Embuldeniya Prof. Priyani Paranagama Ms. Sakunthala Tennakoon

31/01/2021	10.00 am- 1.00 pm	Dr. Chandra Embuldeniya Prof. Priyani Paranagama Ms. Sakunthala Tennakoon
04/02/2021	5.00pm-8.00pm	Dr. Chandra Embuldeniya Prof. Priyani Paranagama Ms. Sakunthala Tennakoon
07/02/2021	10.00 am- 1.00 pm	Dr. Chandra Embuldeniya Prof. Priyani Paranagama Ms. Sakunthala Tennakoon
08/02/2021 - **To date (28/4/2021)**	After handing over the draft report to the ITI	We have held several meetings online and telephone conferences to accommodate the revised data provided by the ITI.

Annex 6 – Awards Received by ITI Staff members

The details given in the Self-Assessment Report are reproduced below.

2.1.8. Prestigious awards

Awards received by ITI staff members.

2017

1. National Research Council (NRC) Merit Awards 2015 -Award for scientific publication
2. Gold medal in 3 MT paper presentation competition 2017
3. Best Research Paper of the Session Award 2017 - FOOD QUALSS 2017, Colombo, Sri Lanka.
4. Best Student Research Award2017 - International Conference on Food Quality, Safety and Security
5. Best Oral Presentation Award Research Symposium 2017- Faculty of Livestock, Fisheries and Nutrition, University of Wayamba
6. Best Poster Presentation in the discipline of "Natural and Life Sciences" 4th International Conference on Multidisciplinary Approaches 2017
7. 9thInternational Research Conference of Kothalawala Defense University - Best Poster Presentation in Basic and Applied Sciences category

2018

1. National Awards for Science and Technology Achievements -2018 - "Excellence in international collaboration for advancement of S&T" – IDRC/ITI project team(organized by the national Science Foundation, Sri Lanka).
2. Achieved Silver Medal winning invention for ‘Low added sucrose nutritious scorn-Flat bread’ in the category of OPEN under technical field of Food Technology at SahasakNimavum -2018 National Exhibition organized by Inventors Commission.
3. Gold Medal – for 'Bio wax' in the commercialized category under technical field of Food Technology at SahasakNimavum -2018 National Exhibition organized by Inventors Commission.
4. President’s awards for scientific publication-2016. In vitro anti-inflammatory and antioxidant activities of ten medicinal plants traditionally used to treat inflammatory diseases in Sri Lanka. Industrial Crops and Products, 2016; 94:610-620.
5. Gold medal: Finalist of SLAYS Three minute thesis Competition (3MT)- 2018.

Organized by Sri Lankan Academy of Young Scientists/ National Science Foundation, Sri Lanka

6. Support Scheme for Supervision of Research Degrees (SUSRED) – Award for Supervision Degrees
7. Presidential Awards -2018 - Development of clay filter body with high fluoride binding ability for the remediation of fluoride contaminated water (Group invention)
8. SahasakNimawum 2018 awards - Environmentally-friendly, controlled-release fruit and melon flies attractive product based on Ocimum extracts and natural-nanocomposite substrate.

9. Dasis Award -2018 - Environmentally-friendly, controlled-release fruit and melon flies attractive product based on Ocimum extracts and natural-nanocomposite substrate.

2019

1. SLCARP Award for excellence in Agricultural Research 2019 - 1st Prize in non-plantation sector in consideration of the research project on “Enhancing preservation of fruits using nanotechnology” – IDRC/ITI project team.
2. SLCARP Award for excellence in Agricultural Research 2019 - 1st Prize in plantation sector in consideration of the research project on “Bioactivity of Ceylon Cinnamon”
3. Gold Medal in the Commercialized Category under Technical Field of Food Technology for the Development of Ready-To-Serve beverage from Aloe vera at “SahasakNimavum - National Invention Exhibition 2019” organized by the Sri Lanka Inventors Commission
4. Gold medal scientific innovation, awarded for MASSAK-NP commercialized product category.
5. SLCARP Award for excellence in Agricultural Research 2019 – Certificate of Commendation in non-plantation sector
6. Awards received by the institution.

Best Annual Report and Accounts Awards for Public Sector 1st runner-up – 2018conducted by the Association of Public Finance Accounts of Sri Lanka (APFASL), the Public Sector Wing of CA Sri Lanka.