REVIEW REPORT

INSTITUTE OF FUNDAMENTAL STUDIES

DURING THE PERIOD 2009 TO 2011

BY

NATIONAL SCIENCE AND TECHNOLOGY COMMISSION

Review Panel

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Members of the Review Panel
10-06-2013

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LIST OF ABBREVIATIONS

AFASSA	Africa, Asia and South America
AvH	Alexander von Humboldt
BFBF	Biofilm Biofertilizer
CCD	Consultative and Collaborative Division
CdTe	Cadmium Telluride
CKDu	Chronic Kidney Disease of unknown etiology
COMSATS	Commission on Science and Technology for Sustainable Development in the South
GC	Gas Chromatography
GIS	Geographical Information Systems
HPLC	High Performance Liquid Chromatography
IFS	Institute of Fundamental Studies
IPCE	Internal Photon Conversion Efficiency
JICA	Japan International Cooperation Agency
MPLC	Medium Pressure Liquid Chromatography
MBU	Microbial Biotechnology Unit
MOU	Memorandum of Understanding
MS	Mass Spectrometry
NBC	Nature's Beauty Creation
NGO	Non-Governmental Organization
NMR	Nuclear Magnetic Resonance
NRC	National Research Council
NSF	National Science Foundation
R&D	Research and Development

RG	RG Lanka Pvt. Ltd.
Rtd.	Retired
S&T	Science and Technology
TB	Tuberculosis
UNESCO	United Nations Educational Scientific and Cultural Organization
UV	Ultra Violet

1. Introduction

This report describes the outcome of a review carried out to evaluate the quality of the research programmes and related issues of the Institute of Fundamental Studies (IFS) during the period 2009 to 2011. The report is prepared by an expert panel appointed by the National Science and Technology Commission (NASTEC) which is mandated by the Science and Development Act No. 11 of 1994 to review the progress of science and technology institutions in Sri Lanka. The Review Panel was asked to assess the extent to which the Institute is achieving the objectives set out in IFS Act No. 5 of 1981 and its Amendments of 1997. The overall objective of the review is to assist the IFS to improve its performance.

This is the first Institutional Review of the IFS carried out by the NASTEC and it is envisaged that the review process will be repeated periodically once in 5 years by the NASTEC. The review was carried out in March and April, 2013. Summary of the review process is given in annex I.

The members of the expert review panel were:

1. Prof. B.S.B. Karunaratne, Former Director, Postgraduate Institute of Science, Senior Professor in Physics, University of Peradeniya
2. Prof. Nimal Gunatilleke, Former Professor of Botany, Professor Emeritus, University of Peradeniya
3. Prof. Anura Wickramasinghe, Dean, Faculty of Science, Senior Professor in Chemistry, University of Peradeniya
4. Prof. Sisira Pinnawala, Professor in Sociology, University of Peradeniya
5. Dr. Jagath Gunatilake, Senior Lecturer in Geology, Chairman, Board of Study in Earth Science, Postgraduate Institute of Science, University of Peradeniya

The purpose of conducting the review is as follows:

- To obtain information on how to improve activities of the IFS
- To assess the effectiveness of the activities
- To encourage good management of IFS
- To improve internal and external transparency
- To recommend future resource commitments
- To gather information for policy change
- To inform the stakeholders about the IFS competencies

In this review the following aspects were examined and evaluated.

- Institutional response to external and internal environment in planning organizational strategy
- Planning S & T programmes and priorities
- Planning S & T/ R & D projects
- Project management and maintenance of quality
- Human Resource Management
- Management of organizational assets
- Coordinating and integrating the internal functions/ units/activities
- Managing information dissemination and partnership
- Monitoring, evaluation and reporting

1.1 Vision, Mission and Objectives of the IFS

(As stated in the Corporate Plan of the IFS- 2010-2016)

Vision: To conduct basic scientific research of internationally acceptable quality to catalyze and uplift scientific and technological activities in Sri Lanka.

To gain a name for Sri Lankan science in the international arena.

To motivate students and younger scientists to engage in advanced competitive research.

Basic research for national development.

Mission: To conduct basic scientific research of internationally acceptable quality, and to uplift scientific and technological activities in Sri Lanka; motivate younger scientists and students to engage in advanced competitive research; promote international cooperation in research.

Objectives:

The aims and objects of the Institute (as stated in the Act No. 55 of 1981, Part 1 as amended by Act No.5 of 1997, section 3) are to create an interest in and to provide facilities for fundamental and advanced studies and in particular to:

a. initiate, promote and conduct research and original investigations to fundamental studies in general with particular emphasis on mathematics, physics, chemistry, life science, social sciences and philosophy, taken in the broadest sense;

b. arrange lectures, meetings, seminars and symposia in pursuance of its research work and for the diffusion of scientific knowledge;

c. invite scientists in Sri Lanka and from abroad actively engaged in creative work to deliver lectures and participate in its research activities;

d. establish and maintain liaison with scientific workers and scientific institutions in other countries and promote international co-operation in matters relating to the aims and objects of the Institute;

e. do such other acts and things as may be necessary to promote the aims and objects of the Institute while taking care to protect and promote the national interest.

1.2. History of the IFS

The concept of an institute for fundamental research was first conceived by the then H.E. the President of Sri Lanka, J. R. Jayawardane in 1979. He invited Prof. Chandra Wickremasinghe from the Cardiff University in the UK, to establish the Institute of Fundamental Studies (IFS). The Institute of Fundamental Studies (IFS) was established by an Act of Parliament in 1981, to promote and conduct fundamental research in the physical sciences, life sciences, social sciences and philosophy.

The IFS began work in 1981, in a two roomed building at the present Colombo office of the IFS. In 1984, Prof. Cyril Ponnamperuma was appointed as the director of the IFS. The government acquired the Hantana Hotel in Kandy and the hotel rooms were transformed to research laboratories. Advanced research equipment was made available through an outright JICA grant from Japanese Government to the value of US $ 5.7 million. Prof. C.B. Dissanayake succeeded

Prof. Ponnamperuma as the director in 1991 and carried forward the research activities until 1994. Prof. K. Tennakone was the director from 1994-2008.

In 2009, Prof. C.B. Dissanayake was once again appointed as the director of the IFS and currently the Institute is in the process of experiencing a major resurgence by focusing the research activities towards national development, developing infrastructure, granting permanent status to the senior research staff, successfully competing for research grants, expanding the science outreach programmes to schools, training of postgraduates. While primary activities of the IFS remain conducting research, disseminating science and training of postgraduates, it has now expanded to Research and Development activities providing consultancy services and giving research recommendations. These activities are facilitated through the newly established Consultative and Collaborative Division.

The IFS is administered by a Board of Governors whose Chairman is H.E. the President Mahinda Rajapaksa, consisting of 11 members. Matters pertaining to research are decided upon by the Research Council. The Research Council consisting of 18 eminent local scientists selected from the IFS and Universities meets once a month to make recommendations to the Board of Governors on all matters pertaining to planning and implementation of research projects.

2. Procedure adopted for Performance Review

The arrangements and timetabling of the site visits were planned by the Review Panel in consultation with the IFS and the NASTEC. The Review commenced with a preliminary meeting of the Panel on 4th March, 2013 discussing the contents of the Self-Assessment Report (SAR). The SAR covered the review period (2009-2011) of the Institute stating a general overview of the institution including organizational structure, planning of S&T programmes, R&D projects/activities, project management, monitoring and evaluation process, consultancy services, science popularization, research recommendations and human resource development in science and technology. The performance review was based on assessing the activities stated in the SAR through meetings, observations, discussions and the documents made available to the Review Panel.

The Panel met for two full day sessions on 5th and 15th of March, 2013 with different groups of the IFS staff. In the evening of 15th March, 2013, initial observations based on the review findings were presented to the Director IFS and the senior members of the staff. The details of the review schedule are given in the annex II.

2.1 Meetings and Discussions

After the welcoming by the Director, IFS, Prof M.A.K.L. Dissanayake, a senior scientist of the IFS, made a presentation based on the Self-Assessment Report on behalf of the Director.

The Director IFS, senior staff members, other staff members including the research assistants were present at this session and the Review Panel had an opportunity to discuss various issues related to the IFS based on the presentation. Subsequently, the panel had several separate meetings with the following groups to obtain their views and discuss problems related to their work. The schedule of the meetings is given in the review agenda (Annex II).

During the review the Panel met with:

- The Director and senior members of the research groups
- Staff of all Divisions (Technical, Finance, Transport, etc.)
- Two members each of the Governing Board and the Research Council
- The Research Leaders of each research programme/project

- Research Assistants of research programmes;
- Officials of the Trade Unions and other Societies
- Three postgraduate students who have completed their degrees (Ph.D. and M.Phil.)
- Representatives of two stakeholder institutions (NSF and NRC) providing research grants to the IFS
- Key stakeholders from private sector involved in the commercialization process

2.2 Observations/Study of Documents

The Review Panel observed/studied the following documents and many other documents/sources related to the performance of the IFS during the review process.

- Self-Assessment Report of IFS prepared for the Performance Review
- The Parliamentary Act of 1981 with the latest Amendments relating to the establishment of the IFS
- IFS Annual Review-Research Session Reports (2009, 2010 and 2011)
- Institute's publications during the last 5 years
- Action Plan for the current year
- Annual Reports
- Corporate Plan (2010-2016)
- List of Stakeholders of the IFS
- Minutes of the meetings of the Research Council and the Board of Governors
- IFS website

2.3 Visiting Research Labs and other Divisions

The Review Panel made visits to the administrative section, laboratories, library, Science Dissemination Unit (SDU) and several other divisions of the IFS as indicated in the review agenda (Annex II). The Review Panel had an opportunity to observe the facilities and the working environment of the staff. The reviewers also used this opportunity to discuss the difficulties specific to projects/divisions and the possible remedial action.

Currently there are 14 research programmes covering the basic and applied sciences, each with several research projects. The details of the projects are given in annex III. Each research project has a senior scientist as the team leader and other scientists, research assistants and a technical officer as group members. In addition, there are also visiting scientists in the research staff. These groups generally conduct their research in collaboration with national universities, research institutes, government agencies, NGOs, foreign universities and institutions. Although it is mandatory for IFS research assistants to register for a postgraduate degree, some research assistants do not work towards postgraduate degrees. In addition, there are also postgraduate and undergraduate students from universities carrying out part of their research at the Institute. The Review Panel visited the research laboratories to meet the research groups and observed the facilities and the working environment of the research staff.

3. Management of IFS

The Panel reviewed the management of the Institute to identify the problems in existing management structure and understand the challenges faced by the Institute in carrying out its mandate.

3.1 Organizational/Management Structure

The IFS is an Independent Research Institute that comes under the purview of the Ministry of Technology and Research. The overall policy making body of the Institute is the Board of Governors the Chairman of which is the H.E. the President (Annex IV). The day-to-day operations of the Institute are the responsibility of the Director who is the Chief Executive Officer reporting to the Board of Governors. The Director is supported by a Research Council of 18 members (Annex V) whose main responsibility is to advice the Director on matters pertaining to research. The Research Council consists of senior scientists representing the local scientific community. In general administration of the Institute, the Director is supported by a team of administrators, technical personnel and other support staff of various categories. At present, there are over 100 employees of various categories including researchers and support staff.

3.2 Management Issues Identified by the Review Panel

IFS is a small organization with a mandate for fundamental research. It is the first and the only Institute of this kind in the country. Over time, the Institute has gradually incorporated applied research into its activities and today the research agenda of the Institute is a mixture of fundamental and applied research.

Though the Institute has a team of senior scientists supported by qualified scientific and technical support staff scientific infrastructural facilities of the IFS still fall short of the required levels. It still operates in a building not originally designed for laboratory work and therefore, the facilities available are not ideally suited for both researchers and equipment. However, construction work of a new laboratory complex is now in progress. The general administration, though suitably qualified and adequately staffed, is constrained by a rigid set of Administrative Regulations and Financial Regulations. The above mentioned shift in the mandate *i.e.*, the research agenda trying to accommodate applied research into its research programmes to cater to the development needs

of the country has added more complexities to this situation. It is in this context that the management of issues of the IFS needs to be understood.

The management issues identified by the Review Panel are presented below, under two broad categories. The first is the issues related to organizational structure which defines the lines of command and control in the organizational operations and determines duties and responsibilities of individual positions within the organizational hierarchy. The second is the issues related to management of human and physical resources of the Institute.

3.2.1 Organizational Structure

The organization of operations of the Institute during the period covered by the review was under a five-tier organizational structure which consisted of four managerial levels and one non-managerial level called the primary level (see Annex VI). The Institute at present is going through a reorganization of its management and a new organizational structure has been proposed and awaiting approval of the Board of Governors.

Lines of Command and Control

Overall administration of the Institute is under the Director who reports to the Board of Governors. During the period under review, he was assisted by the Secretary/Deputy Director in running the day to day operations. The management of the Institute has undergone some changes during the period under review and one of the changes that has been introduced was to place the Research Assistants in the Middle Management level. The placing of Research Assistants at the Middle Management level was found to be a matter for concern. The Review Panel feels that research assistants not being part of the permanent staff of the Institute, should not have a role in the management and they should come under the direction of the Senior Scientists. Another change that has been brought in is separation of the post of Deputy Director from Secretary though the position has not yet been filled.

Duties and Responsibilities of Positions

Duties and responsibilities of positions and their relative status in the organizational hierarchy have been disrupted by recruitment policies that have come into effect recently. Among the affected are the Technical Officers.

In 2011, IFS adopted a salary scheme recommended by the Department of Management Services (DM/E2/01/7/269/2) and this created a salary anomaly affecting those who were recruited after February 2011. The most affected as a group is the Technical Officers. This is a deviation from the principle that similar duties and responsibilities enjoy similar benefits and privileges which is the norm in management practices in the state sector. The above recruitment policies seem to have had repercussions on human resource management of the Institute. They have resulted in divisions leading to conflicts affecting the smooth functioning of the Institute.

Organizational Culture, Management and Administrative Practices

Organizational culture of the Institute is characterized by lack of flexibility in administrative and management practices which the Review Panel believes is the result of both lack of proper understanding of the unique nature of the Institute and also over-adherence to Administrative and Financial Regulations by the administrative staff. One example is the insistence of the financial administration that technical committees and tender boards should meet only on specific days and set number of times during a month.

3.2.2 Management of Human and Physical Resources

The Review Panel feels that the Institute's management of both human and physical resources needs improvement. The work environment and facilities available are not best suited for the efficient performance by its staff. Some of the assets of the Institute remain under-utilized. The Institute is also handicapped by not having a well-defined human resource development plan.

i). Management of the Institute is blamed by the staff for not being able to provide adequate facilities to staff for their career development. The complaints are coming from the Research Assistants and the Technical Officers that the Institute is unable to provide for their career development but at the same time there is very high expectations on their part of what should be provided by the Institute. For example, the Review Panel observed a clear reluctance on the part of RAs to accept opportunities available in certain countries in Asia and in Central and Eastern Europe for further studies preferring to go to the West particularly to those that are English speaking. The Review Panel considers that this expectation is rather unrealistic in modern times.

ii). The facilities provided for the staff in general are inadequate. The lunch area of the staff has minimum of facilities which has the ambience of a canteen more than a lunch/tea room of a prestigious research institute. On the other hand, the lobby area that is meant for the staff to read newspapers and relax and engage in informal conversation is underutilized.

iii). In addition to its laboratory complex and head office in Kandy, IFS has a property in Colombo which is presently used as a coordinating office cum lodging facility for IFS personnel visiting Colombo. The IFS also has a land in Dambulla which it has acquired with the intension of establishing an extension to the existing arboretum. The Colombo Office is managed by an officer of middle management who had been a Scientific Officer in Kandy until she was posted to Colombo. The Panel questions the wisdom of employing a Scientist to do routine office management work.

iv). Colombo Office is used only for providing lodging facilities and occasional coordinating work in Colombo on behalf of the IFS. Until recently this office premises was shared with the National Research Council (NRC). Other than this shared use and utilization of the premises for lodging facilities of the staff visiting Colombo, the Panel however did not see any evidence of work that is being carried out that warrants maintaining an office in Colombo.

3.3 Challenges of the IFS

The challenges faced by the IFS can be divided into two categories as those that are unique to IFS and those that are common to any scientific research organization. The challenges in the first category arise out of the mandate of the Institute which is promoting fundamental research. The challenges in the second category are challenges of meeting practical constraints imposed on the Institute by the socio-political reality of conducting research in a country like Sri Lanka.

3.3.1 Implementing the original mandate of the Institute.

The IFS was originally established with the purpose of promoting fundamental research in the country. Though this is a praiseworthy act addressing a felt need of the country the circumstances have compelled the successive governments to encourage research that have

immediate applications. As such, pressure exerted on the Institute to focus more and more on applied research thus making it deviate from its original mandate. One could argue that the focus on applied research inevitably dilute the original mandate of the Institute.

The Institute has failed to bring in research in social sciences and philosophy as required by the original mandate. There is lack of clarity and understanding in the Institute about the place of social science research in its work plan. During the period under review there have not been research projects in social sciences in the research agenda of the IFS. Further, fundamental social science research is not part of the mainstream academic tradition of Sri Lanka where there is little academic interaction between natural scientists and social scientists. However, the Review Panel is of the view that with proper planning the IFS can take a lead in this direction.

3.3.2 Practical Constrains in doing Research

There also are several practical constraints faced by the Institute in achieving the mandated objectives. These are part of the political realities of the country that are beyond the control of the management. Not only funds and suitable expertise for fundamental research in natural sciences are in short supply but also the availability of funds for research is dependent on the ministerial leadership.

Scarcity of Expertise

The fundamental research in sciences is a highly advanced field of research that requires suitably qualified and dedicated scientists. Sri Lanka's production of scientists is limited and of them the best now, unlike in the past, have the tendency of leaving the country at early age. Of those who opt to remain in the country the first preference is the University system where their salaries and benefits are better[1]. This has resulted in a limited pool of suitably qualified young and energetic scientists for the Institute to choose from.

Constraints of funds

In developed countries, wealthy donor philanthropists are the main source of funding for research that is not generating immediate benefits. Unfortunately this is not the case in developing countries like Sri Lanka. Fundamental research, for its inability to generate

[1] There was a time the IFS was paying its scientists better salaries and better fringe benefits but now the situation has changed.

immediate commercial benefits, is not something that is attractive to investors from corporate sector whose main concern is the application of results for immediate benefits (profits). Therefore, the IFS has to depend almost entirely on state funds. However, the state is unable to do so due to financial constraints it is facing and also for its priorities are elsewhere, *i.e.*, applied research. The alternative of corporate funding is not a viable proposition as it will result in further moving away from the mandate if business sector is brought in and commercialization of research is expanded.

Lack of understanding of the mandate by Ministerial leadership

Another challenge faced by the Institute seems to be the lack of proper understanding on the part of the ministerial leadership of its mandate. In line with the national priorities in scientific research which is development related research, and also as a solution to contracting state funds the ministerial leadership insists the Institute to focus on applied research in collaboration with the private sector. This is not desirable in executing the original mandate of the Institute.

4. Services and Outputs of IFS

4.1 Types of services and Research Outputs

While primary activities of the IFS remain conducting research, disseminating information on science and training of postgraduates, it has now expanded to Research and Development activities providing consultancy services and extension services. These activities are facilitated through the newly established Consultative and Collaborative Division (CCD). The division has been established to direct basic research towards national development in collaboration with outside organizations such as universities and research institutes as well as corporate and private sector organizations. The division is also expected to offer consultancy services and undertake commissioned research that would impact positively on national development.

Human Resource Development at different levels in Science and Technology is also an integral part of the activities of the Institute. Human resource development for the research staff is provided through in-house workshops, participation in national and international workshops and presentation of research findings at national and international forums. Besides participating in numerous workshops and training courses, the IFS also hosted two major international conferences in 2011, one on natural products and the other on solar energy.

The Science Dissemination Unit conducted programmes for school teachers and students through workshops, seminars, competitions, exhibitions and laboratory demonstrations. Scientists and research assistants were also the recipients of many international and national awards. The findings from the research activities have been published in international and national peer reviewed journals, in conference proceedings and abstracts, in technical and consultancy reports, and miscellaneous publications. Being an institute engaged in conducting advanced research, the work carried out by its researchers are recognized in the form of fellowships, awards and other various appreciations.

4.2 Assessment of Services and Research Outputs

The IFS contributes to the national economy and national development through research activities and human resource development in the sectors of Energy, Health, Agriculture,

Environment, Natural Resources and Education. Under the energy sector, research programmes are conducted on developing renewable and environmentally friendly energy sources. These include the development of solar cells, exploration for geothermal resources in the country, development of thermoelectricity and biofuels. In agriculture, bio-filmed bio-fertilizers are being developed for plantation and several other field crops which would reduce the use of chemical fertilizers. Other research programmes include improvement of mustard and studies on exploiting the nutritional properties of *Moringa oleifera* (Sinhala - *Murunga*). The Natural Products research group is investigating the isolation of environmentally friendly compounds from indigenous flora. Research activities under environmental pollution and mitigation emphasize the providing of clean drinking water, removal of fluoride and other pollutants from our water sources, and monitoring and characterization of waste water. In the health sector, research is conducted on developing molecular methods to diagnose tuberculosis and developing a dengue risk map by incorporating environmental and socio-economic parameters to dengue incidence in urban areas. Assisting patients with neurological and speech disabilities is the focus of a research project to provide handicapped patients with a communication means using a brain-computer interface.

4.2.1 Patents

In 2009, a Portuguese patent application has been filed and granted for "Method for perpetrating electrochromic inks". The work has been carried out together with a group of Portuguese scientists.

4.2.2 Research Publications

During the 2009-2011 period, the Institute published 60 research publications in refereed journals, 143 abstracts as conference proceedings (Table 1), and over 150 technical and consultancy reports, advisory material, newsletters, and other publications (Annex VIII).

Table 1: Publications during the period 2009 - 2011

Year	Publications	Book Chapters	Abstracts
2009	13	02	27
2010	15	05	46
2011	32	03	70

4.2.3 Awards and Recognitions

The Director of the Institute has been bestowed with the Doctor of Science (*Honoris causa*) degree, the highest academic honour given by a University, by the Sabaragamuwa University of Sri Lanka. Several research professors and senior research fellows have been awarded visiting professorships, research fellowships by several foreign Universities and other funding organizations such as the Alexander von Humboldt Foundation recognizing their research work. The work carried out by research assistants have also been recognized through both local and foreign awards such as Kandiah Memorial Award for Chemistry and IUPAC young Chemist Award. Many researchers have received Presidential Awards for their scientific research.

The noticeable observation is the upward trend in all types of services and outputs of the Institute since 2009.

4.2.4 Training (Human Resource Development)

Every year over 30 graduates are provided with postgraduate training for their Masters and Doctoral degrees, while many undergraduate students from national universities also conduct their project training at the IFS.

Postgraduate degrees

During the review period 2009 – 2011, two Ph.D. degrees and seven M.Phil. degrees have been awarded by University of Peradeniya for the research work carried out at the Institute.

In 2009 – 03 M.Phil. degrees and one Ph.D. degree

In 2010 – 02 M.Phil. degrees

In 2011 – 02 M.Phil. degrees and one Ph.D. degree

Training Programme for Technical Officers

One notable contribution is the training programme for technical officers on instrumentation. Fifteen technical officers from various government institutions have been trained providing them the basic theoretical background and hands on experience with simple instrumentation on analytical instruments.

4.2.5 Dissemination of Information on Science

Science Dissemination among teachers and school children

The Science Dissemination Unit has conducted programmes for school teachers and students through workshops, seminars, competitions, exhibitions and laboratory demonstrations. Over 1200 school teachers have participated in eight teacher training programmes in Sinhala and Tamil media, and over 900 students have taken part in seven science education programmes conducted by the IFS during the period of 2009-2011. Nature education programmes have also been conducted for teachers, school children, undergraduates and the local community to make them aware of the importance of the environment.

Educational visits by undergraduate students and school children to the IFS have also been a part of the science dissemination programme and 16 such visits have been arranged during the period under review. In addition to these, the IFS has taken part in *Deyata Kirula* exhibitions in 2010 and 2011.

The school science programme is an important annual event organized for the dissemination of science among the younger generation. The programme is conducted by bringing together young minds from varied ethnic, religious and economic backgrounds of the country and exposing them to a novel intellectual experience with the intention of stimulating their thinking and imagination ability and arousing their curiosity and excitement towards new ideas. This is a new experience for the children coming from diverse backgrounds in the country where they learn to understand each other and respect differences among themselves as individuals.

Two all island competitions on scientific concepts and on Nanoscience have also been held inviting 250 teachers and 1160 students. The competition for students has been mainly focused on enhancing enthusiasm of students to choose science and to make them understand that the complex facts and workload is not a burden but an enjoyable activity. The competition for teachers had been designed to enlighten the teachers that the scientific concepts and knowledge should be presented to the students in an intuitive manner relating to their everyday life experiences.

Conferences/Symposiums and Workshops

The Science Dissemination Unit has also organized several conferences and workshops in keeping with its objective to bring together leading experts in different areas of science, foster the exchange of technical and scientific information by providing a forum for the scientific community, and to promote public understanding of science. The Institute has hosted an International conference on "Solar Energy Materials, Solar Cells and Solar Energy Applications" and an International Symposium on "Natural Products and their Applications in Health and Agriculture" in 2011.

One workshop on "Bioassays for Natural Products Research" and another on "Effective Use of Microbial Biofertilizers for an improved Economy and Environment of Sri Lanka" have been conducted in 2010 and in 2011, respectively.

Science Website in Sinhala

The Institute has developed a Science Website in Sinhala named "*Vidu Mang Petha*" with the intention of disseminating knowledge in science among Sinhala speaking people. The Website provides scientific knowledge and information through English-Sinhala glossaries and dictionaries and E-booklets. The IFS is in the process of making the Tamil translation of this Website available to the public.

Documentary films

A series of 14 films of 30 minutes duration each have been produced by the Institute incorporating the scientific discoveries of the IFS scientists on the behavior of monkeys to educate and inspire people around the world towards conservation of nature. The series entitled "Dark Days in Monkey City" is being broadcast on the Animal Planet programme of the Discovery Channel.

4.2.6 Important outcomes from Projects/Programmes (New Products Developed/Technologies Transferred)

Electro Coagulation Unit for the removal of fluoride from drinking water

IFS in collaboration with a private enterprise, Link Natural Products Pvt. Ltd. had launched a project to develop an electrocoagulation unit to remove excess hardness and fluoride in drinking water. The Electrocoagulation methodology has been developed by IFS scientists and adapted for its simplicity to remove excess hardness and fluoride in drinking water. The Electro Coagulation unit was designed and fabricated at Asokamalagama, Pemaduwa, a village where drinking water had high fluoride content and hardness, thus reducing the fluoride content in the drinking water.

Ten more water purification units have been successfully installed in the North Central Province.

Development of high efficiency, low cost solar cells

Under two major research programmes, Photochemistry and Condensed Matter Physics/Solid State Chemistry, IFS has been able to produce lab scale low cost, dye sensitized solar cells with efficiencies around 5%. The work is continuing in order to further optimize the performance of these solar cells before they are ready for R&D and commercialization.

Biofilm Bio-fertilizer

The Microbial Biotechnology Unit of the IFS has developed a novel microbial bio-fertilizer called Biofilmed Bio-fertilizers to overcome the problems caused by continuous use of chemical fertilizers and agrochemicals.

Pilot scale production of these Bio-filmed bio-fertilizers has commenced by a local entrepreneur, Nature's Beauty Creations, which has bought the project on equity and 2% royalty payment basis. The intension is to produce the fertilizer in commercial scale and both the Institute and its researchers involved in the project will benefit in the long run.

Sinhala language-based artificial intelligence

Sinhala speech database using Sinhala Phonemes and computer software for converting Sinhala text to Sinhala speech has been developed. Electronic glove has been designed and constructed which can be used not only with speech devises but also with any multimedia system. EMG amplifier was designed and constructed for converting instructions given by slight movements of muscles. This will help individuals with speech disabilities (non-vocal) to communicate with the public who may or may not understand sign languages. The objective is to develop a portable electronic system which can produce Sinhala speech, according to input received.

Geothermal Resources Mapping Programme

For the first time in Sri Lanka, remote-sensing geophysical technique called magneto-telluric (MT) was employed during the investigation of the sub-surface geology in and around thermal springs. Time-domain electromagnetic (TDEM), another modern geophysical technique was also introduced at the same time.

Science Dissemination Unit has developed a range of models to facilitate understanding of basic scientific concepts through Periodic Table, Bucky Ball, Home Laboratory and Science Posters etc. Through regular outreach activities and in-house programmes the SDU has provided short term training to a large number of school students and teachers in order to promote and popularize science.

Software development for Research

One research team has developed the main brain computer interface software called "Identification of Mental Tasks through EEG" which carried out signal processing and classification of EEG data. This software has a Graphical User Interface (GUI) with user friendly features and supports various signal processing techniques.

Molecular techniques for tuberculosis (TB) diagnosis

Spoligotyping, a new molecular method for simultaneous detection and typing of *M. tuberculosis* complex bacteria is based on PCR technique and avoids the timing problems associated with the slow growth of the bacteria.

Environmental friendly bioactive natural products

Studies have been carried out on the Chemistry and bioactivity of edible fruits, plants secondary metabolites and fungal toxins with special reference to endophytic fungi using numerous bioassays. These studies have led to the isolation and identification of several bioactive extracts and pure compounds which can be applied in agriculture (fungicides, weedicides), and as dietary ingredients (anti-obesity, antidiabetic) for food items and beverages.

During the past few years the Natural Products division has developed the following bioassays in their laboratories:

- Antioxidant activity
- Antifungal activity
- Phytotoxic activity
- Cytotoxic activity
- Mosquito larvicidal activity
- Enzyme inhibitory activity
- Haemolysis test

National Reports

- Some of the IFS scientists have contributed to the preparation of the Second National Communication on Climate Change by Sri Lanka (2009-2010) to the United Nations Framework Convention on Climate Change (UNFCCC).
- A scientist from the IFS has contributed to the preparation of a report for the review of science and technology institutions in Sri Lanka for the National Science and Technology Commission, Sri Lanka (2008-2009).
- Development of the Ussangoda serpentinite site to a geo park. As an outcome from NSF funded research conducted on the Ussangoda Serpentinite site in Hambantota, the IFS scientists contributed to draft the nomination documents to the UNESCO to declare the

Ussangoda sepentinite site as a geo-park. This is conducted by the Man and the Biosphere Committee of the National Science Foundation of Sri Lanka.

5. Overview and Recommendations

5.1: Overview of the Performance of the IFS

The aims and objects of the IFS is to *'create an interest in, and to provide facilities to initiate, promote, and conducting original research in fundamental and advanced sciences, in general'*(IFS Act No. 55 of 1981, article 3). The realization of these laudable objectives needs long-term commitment to, and continuing investment in every conceivable manner by all stakeholders.

i. Despite the changing government policies since inception of the Institute, there is clear evidence that the IFS has been able to achieve a satisfactory progress in realizing some of its mandated objectives while addressing, at the same time, several key national development goals through its strategic planning and implementation process during the period under review (2009 – 2011) which indeed, is praiseworthy.

ii. Scientific staff with higher post-graduate qualifications constitute only around 20 - 25% of the S & T cadre during the review period and their overall collective performance in realizing this selection of the mandated objectives appears to be satisfactory despite prevailing constrains.

iii. Winning several national and international awards/fellowships/grants as well as the research output displayed by way of an impressive list of publications, particularly during the period under review, are creditable achievements of the Institute in keeping with its aims and objects.

iv. The IFS is uniquely placed among other research institutions of Sri Lanka by having a Board of Governors headed by H.E. the President of Sri Lanka with both the Prime Minister and the Leader of Opposition among its membership. The review panel is of the opinion that the IFS has not made the best of this unique advantage although this has been identified as a strength in the SWOT analysis.

v. The strengths identified in the SWOT analysis, most of which had been in existence over a long period of time, could have been made use of to their optimal potential,

in reducing the weaknesses identified, alleviating the threats or in seizing the new opportunities that are briefed in the analysis. The review panel feels that this had not been addressed effectively over the years.

vi. Regular participation of the outside members of the Research Council (RC) and also that of the Board of Governors (BoG) was not evident. The regular RC and BoG meetings seem to have had an overwhelming representation of the internal members of the Institute due to irregular participation of outside members. As a result, the expected contribution of the BOG and RC could not have been optimally realized. This trend needs to be seriously discussed in another SWOT analysis workshop and appropriate measures should be put in place to improve the situation.

vii. The research output of the institute had been seriously affected by some internal discords apparently occurred during the period 2008-2009 as revealed by some of the interviewees. However, the Panel is of the opinion that the IFS is recovering from this set back and progressing satisfactorily forward.

viii. The presence of a) about 30 graduate research assistants which is about 40% of the S&T cadre of the Institute, b) the full cadre of technical staff and c) also the cohorts of volunteers joining from time to time together form a valuable human resource pool. The review panel is of the opinion that this resource pool could be more beneficially utilized by the senior scientific staff than done at present to the strategic advantage of the institutional performance.

ix. In order to get the best out of the valuable human resource pool, the need for a more effective dialogue among different categories of staff was clearly evident during our discussions with the staff. Being a relatively smaller institution, build up and consolidation of inter-personal relationships to infuse team spirit among these disparate categories of staff (e.g. administrative and research staff, senior and junior scientific and technical staff etc.) seems essential in order to realize the institutional mission stated in the Corporate Plan. In this regard, the Institute could consider developing a well-defined human resource development plan (also see section 3.2.2)

x. The effectiveness of administrative procedures and support for project implementation as well as reciprocal co-operation of the scientific staff in administrative matters appeared to be a major concern which needs urgent attention

of the Research Council as well as that of the BoG. In this regard, the institute could take a cue from other similar institutions including the universities as to how they have effectively stream-lined these procedures by minimizing administrative bottle-necks.

xi. While the participation of senior staff in programme/project planning and priority setting is clearly evident, the consultative contributions of other staff on the feasibility and operational aspects of the projects/programmes did not appear to be uniformly recognized but seem to vary from project to project.

xii. The issue of acute shortage of expensive equipment and limited access to frontier journals for research raised by the scientific staff is a common problem prevalent in similar institutions in most developing countries and Sri Lanka is no exception. Relying on government funding in an extremely competitive environment for limited financial resources is not very prudent. This deficiency could perhaps be overcome at least to some extent by sharing such resources locally and in implementing the Article 3d of the IFS Act No. 55 of 1981 *viz. 'establishing liaison with scientific institutions in other countries and promoting international co-operation in matters relating to the aims and objects of the Institute'* more effectively than done at present. Notwithstanding this, it is encouraging to note that the team leaders of several research projects/programmes have been able to secure at least some equipment through competitive local grants and through international collaboration setting an example to the others.

xiii. There are several emerging multidisciplinary projects with collaborations both within the institute as well as those outside (local as well as overseas) which have the promise of becoming commercially viable and thus attracting private sector partnerships. Some of these involve both fundamental and advanced studies as well as applied research in keeping with the IFS mandate.

xiv. Among the research assistants, there are those who are registered for research degrees and conduct research through research grants obtained by senior research staff. However, there appear to be a small number of research assistants within this pool who are apparently not registered for any higher degree but are expected to assist the senior researchers in their research projects. Ways and means of motivating them and increasing their sustained commitment to the projects need to be explored and implemented.

xv. With respect to dissemination of knowledge through engagement of school children as well as teachers and also university students from different parts of the country, the Institute seems to have played an active role during the review period . Among its commendable activities on school science programmes are conducting lectures, holding exhibitions, providing practical experience, publishing a newsletter and developing an interactive web site. The web site *Vidu Mang Petha* could be more fully utilized for this purpose by securing additional resources it needs by collaborating with agencies like the ministry of education, NIE, UNESCO, *Vidatha* Programme etc.

xvi. The provision of facilities and even training for university students and staff is a praiseworthy service in keeping with the ideals of sharing limited resources available within different institutions of the country. These activities also lead to opportunities for inter-institutional collaboration and they could be organized in a more formal footing so that the contributions of each stakeholder is duly recognized and acknowledged in the most appropriate manner.

5. 2 Recommendations:

i. Both the SWOT analysis and the Corporate Plan for 2012-2016 needs careful updating with significant improvements to each of them in the light of the observations and recommendations given in this document. In doing so, it could take into consideration the recent developments especially those during the period under review as well as the proposed expansion of the infrastructural facilities of the Institute including the establishment of the new multistoried building. The preparation of these documents could perhaps be better achieved with external professional advice and assistance in consultation with the Research Council and the Board of Governors.

ii. Each of the 14 or so research areas currently pursued by the individual research groups of the Institute are described rather loosely perhaps, as projects/programmes in the institutional review. The programmes are higher in research hierarchy than projects. Since the programmes include an organized set of research projects oriented towards the attainment of specific objectives, it may be better to view the current projects/programs in that perspective and reorganize them (where

necessary) as thematic programmes with national development goals in mind and in consultation with the project staff and the stakeholders.

iii. The Review Panel recommends that the IFS should focus more on theme-based research programmes rather than on projects selected in an ad-hoc manner. The directorate should re-examine and strengthen the most promising theme-based research programmes executed in line with the mandate of the Institute with appropriate resources initially over a specified period of time. They should be further elaborated and budgeted in the Corporate Plan for that period and evaluated at regular intervals against the targets set at the beginning.

iv. Due consideration also need to be given to areas of research mandated by the IFS Act but hitherto not taken on board in the regular programmes of the IFS. The Review Panel has made reference to this aspect in several instances in this document which need to be taken note of.

v. In the development of the Corporate Plan, some of the key areas of research which have not received the attention they deserve so far, may be given due consideration in developing new thematic programmes and also in recruiting new staff (for example – see the recommendations vii, viii, ix and x below).

vi. In this context, the research expertise and administrative experience of several senior scientists recruited as contractual staff will become very beneficial and this resource need to be optimally utilized through innovative and strategic planning.

vii. Being identified as the foremost institution in the country devoted to fundamental research in the Corporate Plan 2012-2016, development of such mandated research areas *viz.* social sciences, mathematics and philosophy of science may be the new frontiers which could be developed in collaboration with the university system and even with overseas collaboration where local expertise is unavailable to the Institute.

viii. In this respect, research in Mathematics and dissemination which appears to be on the decline at the national level could be considered as a priority area for expansion. Thought provoking press reports that appeared recently (e.g. *The Island –feature article on Monday 08th April 2013, page 11*) have highlighted and analyzed this deficiency very critically based on the results of the (O/L) and (A/L) results in recent times. It has been suggested that the Government aspirations to become a leading 'Educational Hub' in Asia needs a lot more improvement in the field of Mathematics, Science and English Education. The IFS could consider contributing to the development of Mathematics education and research in collaboration with the Universities and the National Institute of Education. Eventually the IFS could develop this as one of its flagship programmes thus contributing in the area of fundamental science to national development.

ix. As an initial step towards developing socio-economic research mandated by the IFS act, the Institute may consider examining different socio-economic scenarios in the IFS projects/programmes that have commercialization potential in selecting their options in relation to national policies on commercial ventures and their socio-economic and ethical implications (For e.g. joint patents on successful commercial ventures with multinational organizations or rural farmer organizations).

x. The senior scientists including the contracted senior scientists with a wealth of experience could also help the IFS to develop the mandated area of research in Philosophy (of Science) that deals with *inter alia* epistemological, metaphysical and moral philosophical (ethical) issues in science as an initial step.

xi. The Review Panel noted that there is an emerging trend encouraged by the funding priorities towards development-oriented applied research rather than fundamental research within the Institute. The institutional directorate should imaginatively maintain a judicious balance among the projects/programmes that have immediate promise in commercialization and those of more fundamental nature which may generate benefits and recognition in the longer term, thus realigning with the current mandate of the Institute. This is an area where appropriate outside members of the BoG and RC perhaps, could play an important advocacy role.

xii. The newly established Consultative and Collaborative Division of the Institute need to be developed in a manner to facilitate activities designed for addressing the governmental policies and strategies while keeping in line with the mandated aims and objects of the Institute.

xiii. The placement of the RAs in the middle management level in the management structure provided to the Review Panel by the IFS, need to be re-examined in an amicable manner in order to sustain the team-spirit among different categories of staff.

xiv. The review team felt that the post of Research Assistant should be on a contract basis leading to the satisfactory completion of a PG degree during a specific period as usually done in the universities.

xv. It was evident from discussions that the institution-based research assistants, newly-recruited technical officers as well as those arriving from the universities from time to time for short periods should have been given a comprehensive crash training programme with respect to the usage of valuable instruments available at the Institute as soon as they first arrived at the institute. This would have helped to minimize and prevent likely break-downs of expensive equipment leading to shortening their useful lifespan and eventual replacement. Responsible engagement in research and proper handling of these equipment need to be ingrained in all groups of researchers working in the Institute.

xvi. With the resurgence of fundamental and advanced research with greater emphasis on application potential directed towards meeting national developmental goals as well as those with broader regional or global application potential, a well thought-out programme of safeguarding intellectual property rights of the Institute needs to be developed. In this context, expertise available at the IFS should be mobilized to contribute towards a national effort in preparing legally binding national documents in this regard for sharing equitable benefits while protecting IPR of the appropriate agencies and individuals.

xvii. The new multi-storied building complex that is being built eventually needed to be equipped with instruments to facilitate the existing as well as future research programmes. Therefore, the Corporate Plan should take

this requirement in to account well in advance and a comprehensive proposal for this purpose has to be prepared with appropriate budget lines.

xviii. The currently available institutional and laboratory safety measures and waste disposal mechanisms need to be re-examined for both the existing buildings as well as for those that will be constructed in the future in conformity with internationally and nationally accepted standards.

xix. Improvement of the computer facilities including better access to internet at the Institute could alleviate at least in part the journal access requirement of individual researchers. Each researcher should then be able to use his/her ingenuity in accessing international literature particularly through scientific collaboration/communication as widely practiced by those in similar institutions around the world.

xx. The physical assets of the IFS available outside its headquarter premises such as its Colombo office and the field research facility in Dambulla appear to remain very much underutilized at present. However, there is great potential for both these valuable assets to be put into much better use. These issues too, should be included in a revised SWOT analysis and the outcomes could be taken in to consideration in the preparation of the new corporate plan/activity plan.

xxi. For periodic monitoring and evaluation of the IFS activities, a Management Information System needs to be set in place.

ANNEXES

Annex I

Summary of the Review Process

Activity	Responsibility	*Time frame*
1. Selection of institutions to be reviewed	NASTEC	*June,2012*
2. Consent of the institution	Institution and NASTEC	*July,2012*
3.Selection of Review Team	NASTEC	*September,2012*
4. Consent of the institution regarding review team	Institution and NASTEC	*November,2012*
5. Forwarding the self Assessment Template to CEO / of institution	NASTEC	*November,2012*
6. Appointment of the Review Team	NASTEC	*February,2013*
7. Training of Review Team	NASTEC	*February,2013*
8. Submission of Self-evaluation Report and other relevant documents to NASTEC	CEO of Institution	*February,2013*
9. Submission of the Self Assessment Report and other documents to the review panel.	NASTEC	*February,2013*
10. Meeting of review team at NASTEC after reading the Documents	Review team	*March 2013*
11. Visit to institution by the review team for review	Review Team and Institution	*5th March ,2013*
12. Preparation of the draft report and factual verification by discussions with the CEO / necessary staff members of the institution	Institution staff Review team	*March to May. 2013*
13. Submission of the final report to NASTEC	Chairman of Review team	*May, 2013*
14. Submission of the final report to Ministry of Science and Technology and CEO of the Institution	NASTEC	*June, 2013*
15. Follow up action	CEO of the institution / NASTEC	

Annex II

Agenda of the review

Day prior to the Review

Neeting of Reviewers

DAY – 1 (05-03-2013)

09.00 – 09.30 am	-	Welcome Meeting with the Director and Heads of Sections
09.30 – 10.00 am	-	Discuss the Agenda of the Review
10.00 – 10.30 am	-	Tea Break
10.30 – 11.30 am	-	Presentation on the Self Evaluation Report-Director
11.30 – 12.30 pm	-	Discussion
12.30 – 01.30 pm	-	Lunch Break
01.30 – 02.00 pm	-	Meeting with the Group Leaders
02.00 – 02.30 pm	-	Meeting with the Administrative Staff
02.30 – 04.30 pm	-	Visiting Research Labs and meet individual Group Leaders including Rhyzobium lab
04.30 – 05.30 pm	-	Observe Documents
05.30 – 06.00 pm	-	Brief meeting of Reviewers

DAY – 2 (15-03-2013)

10.30 – 11.30 am	-	Meeting with research Students/ Research Assistants
11.30 –12.30 noon	-	Meeting with Technical & other Staff
12.30 – 01.00 pm	-	Lunch Break
01.00 – 01.45 pm	-	Observe Documents
01.45 – 02.30 pm	-	Visiting other Divisions and Observing Institute's facilities (Library, IT unit, Science Dissemination unit (SDU), etc.)
02.30 – 03.00 pm	-	Meeting with Officials of the Trade Unions and the other Societies
03.30 – 04.30 pm	-	Meeting with Director & Staff for Reporting
04.30 – 05.30 pm	-	Brief Meeting of Reviewers

DAY – 3 (04-04-2013)

0200 – 02.45 pm	-	Meeting with passed out research Students (Ph.D- 2012)
02.45 –03.30 pm	-	Meeting with M. Phil (Completed -2002-2006)- Currently Registered for a Ph.D- Completed bench work
03.30 – 04.30 pm	-	Meeting with a Member of the Board of Governors and a member of the Research Council
05.00 – 06.00 pm	-	Meeting with a Member of the Board of Governors

DAY – 4 (30-04-2013)

10.00 – 10.45 am	-	Meeting with NSF Officers dealing with research grants to the IFS
10.45 –11.30 am	-	Meeting with N11 Officers dealing with research grants to the IFS
11.30 – 12.30 pm	-	Visiting the IFS Colombo Office Lunch
02.00 – 03.00 pm	-	Meeting with Mr. Samantha Kumarasinghe, MD & CEO, Nature's Beauty Creations, to discuss about the research collaboration with IFS on Biofilm Biofertilizers for tea

DAY – 5 (13-05-2013)

2.30 – 05.45 am	-	Meeting with the Director IFS (CEO of the institution) for factual observation before submission of the draft report to NASTEC.

Annex III

Research Projcts and Status of Performance During the Last 3 Years (2009-2011)

Project: Ecology and Environmental Biology	Status	
	On-going	Completed
2009 -2011		
1. Biodiversity of spiders and pseudoscorpions	√	-
2. Biodiversity of economically important orchids of the genera Bulbophyllum and Dendrobium	√	-
3. A comparative survey on phytoplankton and zooplankton in Sri Lankan reservoirs.	√	-

Project: Environmental Engineering/Electrochemistry (initiated in 2011)	Status	
	On-going	Completed
2011		
1. Development of low cost adsorbent materials for pollutant removal	-	√
2. Anodic oxidation of phenol in contaminated water on dimensionally stable anode	√	-
3. Development of electrochemical technologies to remove organic and heavy metal pollutants present in pesticides	√	-
4. Development of an electrochemical technology to remove nitrate from contaminated groundwater	√	-

Project: Geothermal Energy	Status	
	On-going	Completed
2009-2011		
Geothermal Resources Mapping	√	-

Project: Food Science and Nutrition (initiated in 2011)	Status	
	Completed	**Completed**
2011 1. Investigating the nutritional properties of *Moringa oleifera* leaves grown in Sri Lanka 2. Investigating the antiobesity effect of commonly consumed cowpea varieties *in vivo*.	√ √	- -

Project: Condensed Matter Physics and Solid State Chemistry	Status	
	On-going	**Completed**
2009 1. TiO_2 film development 2. Using Gold Nano particles. 3. Using Metal Oxides (Ni, Mg etc.)	 - - -	 √ √ √
2010 1. The use of natural dyes as sensitizers; 2. The use of CdS Quantum dots as sensitizers; 3. Film development with SnO_2 with Idoline D – 149 via dual chelation	 - - -	 √ √ √
2011 1. Development of Polymer electrolytes for dye sensitized solar cells and their efficiency enhancement 2. Fabrication of a low cost antibacterial water filter based on polymer nanofibres	 √ √	 - -

Project: Theoretical and Computational Science	Status	
	On-going	**Completed**
2009		
1. Quantum Mechanics and Quantum Chaos	√	-
2. Brain Computer Interface	√	-
3. Microcontroller based speech system	√	-
2010-2011		
1. Quantum Mechanics and Quantum Chaos	√	-
2. Sonoluminescence (Experimental)	√	-
3. Sonoluminescence (Theoretical/Computational)	√	-
4. Brain Computer Interface	√	-
5. Microcontroller based speech system	√	-

Project: Natural Products	Status	
	On-going	**Completed**
2009-2011		
1. Plant secondary metabolites	√	-
2. Fungal toxins, isolation and bioactivity	√	-
3. Potential uses of proanthocyanidins from Tea	√	-
4. Chemistry and bioactivity of edible fruits of Sri Lanka	√	-

Project: Cell Biology	Status	
	On-going	**Completed**
2009		
1. Study on Cyanobacteria	√	-
2. Study on *Mycobacterium tuberculosis* strains		
(a) DNA fingerprinting of TB	√	-
(b) Multidrug-resistant Tuberculosis	√	-
2010		
1. Study on Cyanobacteria		
(a) Molecular Phylogenetics of	√	-

Cyanobacterial species in Sri Lanka (b) Cyanotoxins & Chronic Kidney Disease 2. Study on *Mycobacterium tuberculosis* strains (a) DNA fingerprinting of TB (b) Multidrug-resistant Tuberculosis 3. A rapid method to detect non –tuberculosis mycobacteria (NTM)	√ √ √	- √ - -
2011 1. Study on Cyanobacteria (a) Molecular phylogenetics of cyanobacterial species in Sri Lanka (b) Cyanotoxins & Chronic Kidney Disease 2. Gene expression analysis: Identifying the missing link in chronic kidney disease of unknown etiology (CKDu) in Sri Lanka 3. Study on *Mycobacterium tuberculosis* strains Multidrug-resistant Tuberculosis 4. A rapid method to detect non –tuberculosis mycobacteria (NTM) 5. Culturing of *Spirulina* - (Mahatma Gandhi Centre)	 √ √ √ √ √	 - - - - -

Project: : Chemical and Environmental Systems Modeling	**Status**	
	On-going	**Completed**
2009-2011 1. Toxic metal release from soils (a) Heavy metal release from serpentine soil 2. Hydrogeochemical classification of groundwater in Sri Lanka (a) Geochemical characterization groundwater in Hambantota District (b) Groundwater quality in Chunnakam aquifer 3. Sustainable use of groundwater in coastal region (a) Effect of population growth and sea level rise on groundwater in Batticaloa 4. Characterization of leachate from solid waste dumpsites and find possible treatment mechanism (a) Case study at Gohagoda 5. Adsorption of pollutants on natural and nano	 √ - √ - -	 - √ - √ - -

materials (a) Arsenic-red earth interaction (b) Laterite-fluoride interaction (c) Chromium removal (d) Pb and Cd removal using low cost materials (e) Fluoride removal 6. Collaborative research on national needs (a) Developing a water safety plan for Kandy South Water Treatment Plant (b) Preparation of guidelines for Solid Waste Management	√ √ √ √ √	- - -

Project: Microbial Biotechnology I	Status	
	On-going	**Completed**
2009 1. Development of biofilmed-biofertilizers (BFBFs) for applications in agriculture, plantation and environment Tea, rice, rubber, bean 2. Soil carbon sequestration and greenhouse gas emission	√ √	- -
2010-2011 1. Development of biofilmed biofertilizers (BFBFs) for applications in agriculture, plantation and environment. Tea, rice, rubber, bean, maize 2. Greenhouse gas emission	√ √	- -

Project: Microbial Biotechnology II	Status	
	On-going	Completed
2009 1. Biofilm based biofuel production Sub project: Development of biofilms for the production of cellulosic biofuels from invasive weeds	√	-
2010 1. Biofilm based biofuel production Sub project: Development of biofilms for the production of cellulosic biofuels from invasive weeds	√	-
2. Soil carbon sequestration and management Sub projects: 13 (a) Potential of soil carbon sequestration in home gardens of Sri Lanka: as a way to mitigate global warming		
(b) Soil carbon sequestration in forest plantations of Sri Lanka	√	-
	√	-
2011 1. Biofilm based biofuel production Sub project: (a) Development of biofilms for the production of cellulosic biofuels from invasive weeds (b) Improvement of microbial strains and biofilms for efficient production of ethanol from cellulosic materials 2. Soil carbon sequestration and management Sub projects: (a) Potential of soil carbon sequestration in home gardens of Sri Lanka: as a way to mitigate global warming (b) Soil carbon sequestration in forest	√	-

plantations of Sri Lanka 3. Land use and carbon sequestration in North Sri Lanka Sub project: Assessment of soil carbon stocks in different land uses in Jaffna district	√ √	- -

Project: Plant Biology	Status	
	On-going	**Completed**
2009-2011 1. Bioremediation of heavy metal pollution in the environment 2. Plant ecology 3. Crop improvement 4. Carbon fixation in our natural forests 5. A GIS Approach to Generating a Dengue Risk Map	√ √ √ √ √	- - - - -

Project: Water Quality Improvement (initiated in 2010)	Status	
	On-going	**Completed**
2010 Design and Installation of Water Purification Plant, Mahavilachchiya	-	√
2011 Design and Installation of Water Purification Plant, Nochchiyagama	√	-

Project: Photochemistry	Status	
	On-going	**Completed**
2009-2011 1. Photo conversion of solar energy into chemical and electrical energies. 2. Investigation of the cause of renal failure in people in Rajarata	√ √	- -

Annex IV

Board of Governors of the IFS 2011

His Excellency the President Mahinda Rajapaksha (Chairman)

Hon. D. M. Jayaratne - Prime Minister

Hon. Ranil Wickramasinghe – Leader of Opposition

Prof. Gamini Samaranayake – Chairman/UGC

Prof. C. B. Dissanayake – Director IFS

Prof. N. K. B. Adhikaram – University of Peradeniya

Prof. U. L. B. Jayasinghe – IFS

Prof. Kapila Goonasekere – Vice Chancellor, University of Vocational technology

Prof. sudarshan Seneviratne - Department of Archeology, University of Peradeniya

Dr. P. Siripalan, 39/11Rabarwatte Mavatha, Nikape, Dehiwala

Prof. M. A. K. L. Dissanayake – IFS

Mr. K. T. Waisundara – Secretary to the Board/IFS

Annex V

Research Council of the IFS

Prof. C. B. Dissanayake, (Chairman), Director/IFS

Prof. S.H.P.P. Karunaratne, University of Peradeniya

Prof. N. K. B. Adhikaram, University of Peradeniya

Prof. S. R. D. Rosa, University of Peradeniya

Prof. A. Senaratne, University of Peradeniya

Prof. P. A. Weerasinghe, Rajarata University of Sri Lanka

Prof. M. A. K. L. Dissanayake, Institute of Fundamental Studies

Prof. R. Weerasuriya, Institute of Fundamental Studies

Prof. U. L. B. Jayasinghe, Institute of Fundamental Studies

Prof. A. Nanayakkara, Institute of Fundamental Studies

Prof. N. S. Kumar, Institute of Fundamental Studies

Prof. J. M. S. Bandara, Institute of Fundamental Studies

Prof. G. Seneviratne, Institute of Fundamental Studies

Dr. M. C. M. Iqbal, Institute of Fundamental Studies

Dr. S. Benjamin, Institute of Fundamental Studies

Dr. D. N. Magana-Arachchi, Institute of Fundamental Studies

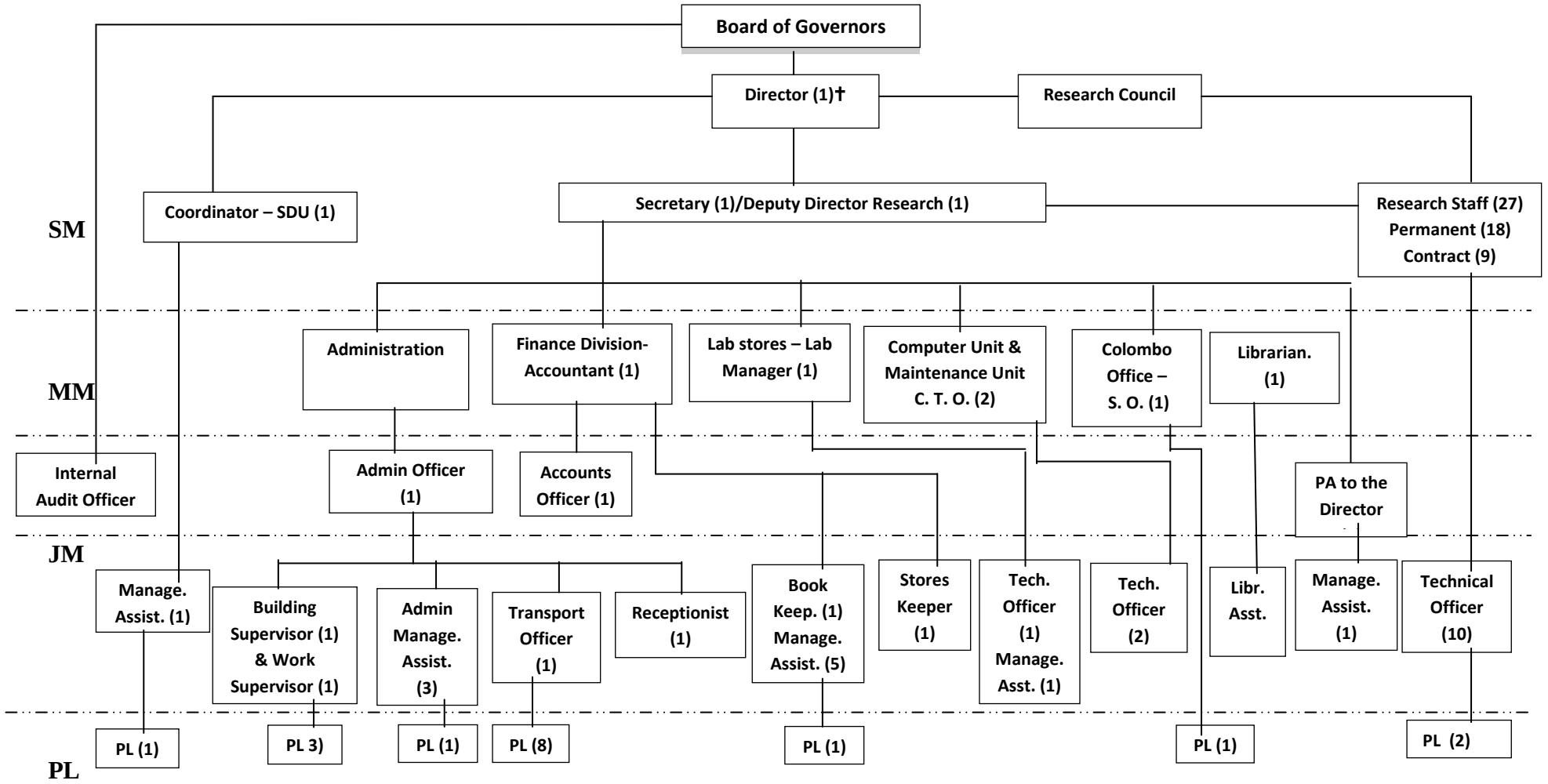
Dr. N. D. Subasinghe, Institute of Fundamental Studies

Dr. R. Rathnayake, Institute of Fundamental Studies

Dr. M. Vithanage, Institute of Fundamental Studies

Annex VI

Management Structure 2011



SM= Senior Management **MM**=Middle Management **JM** = Junior Management **MA**= Management Assistant **PL**=Primary Level
SO=Scientific Officer CTO=Chief Technical Officer SDU= Science Dissemination Unit **†** = Contract appointment

Annex VII

Management practices assessment

(1) Always used/ always considered/ involved/analyzed	≡	**Strong**
(2) Occasionally used/ considered/ involved/analyzed	≡	**Moderate**
(3) Not used/ Not considered/ Not involved/Not analyzed	≡	**Weak**

i) Assessment of Institutional Response to External and Internal Environment in Planning Organizational Strategy

The external environment of an institution (e.g. consumer/industry needs, government policies, market conditions, partners, and competitors) will critically affect its performance. Science & Technology institutions need to regularly assess these in order to plan and respond effectively to challenges and opportunities, and to deliver results that are relevant and useful.

The external environment of Science & Technology / Research & Development institution is vibrant due to changes in stakeholder conditions and needs. It is important for an institution to periodically review and adjust its directions and goals, to meet these changes. These adjustments in turn may require significant actions, such as changes in focus and programs, organizational structure, and management strategies.

Management practice	Level of Practice (Performance Indicators)			Comments / Evidence
	Strong	**Moderate**	**Weak**	
Government policies and development goals are used/ considered to establish goals and plan organizational strategy for the institution		**X**		Used as far as possible within the institute mandate . There appears to be a subtle difference between the original mandate of the institute and the subsequent policy directives of the Govt..
The organizational mandate (as specified by the relevant Act) is considered in strategic planning		**X**		Yes.
The institution is responsive to changes in Government policies and strategies		**X**		Yes. During the period under review the institute has been able to achieve a balance between its mandate and the current govt. policies in its strategic planning.

Factors such as strengths, weaknesses, threats and opportunities are considered in strategic planning		**X**		Yes. Indicated in the self assessment report. However, it is doubtful whether this has been seriously considered in strategic planning.
Stakeholders needs are taken into consideration in strategic planning		**X**		Accommodated within available financial resources.
The Board of Governors is involved in strategic planning			**X**	Yes, but to a limited extent. There is however, scope for further improvement.
The extent to which staff members are involved in strategic planning		**X**		Strategic planning is done by the staff members in the research council. Needs stronger commitment in planning.
Government allocations and alternative funding opportunities (donor funding) are considered in strategic planning		**X**		Yes. Yet there appears to be no clear long term strategy.
The extent to which policies and plans of the organization are reviewed and updated		**X**		Being done since 2009.

Additional observations (if any)

ii) Planning S & T programs and setting priorities

A program is "an organized set of research projects, activities or experiments that are oriented towards the attainment of specific objectives". Programs are higher in research hierarchy than projects. Program objectives should be consistent with organizational strategies and reflect user needs and development goals.

Management practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
National development goals are considered in planning programs & setting priorities		X		Yes. Vary from project to project.
Board of Governors participate in planning and priority setting of program			X	Done by the Research Council and reviewed and endorsed by the Board of Governors.

The extent to which the staff of the institution participate in programme planning and priority setting			**X**	To a large extent through the Research Council. A mechanism should be developed to take on board constructive suggestions made by the other staff in program planning.
Stakeholder interests are considered in programme planning		**X**		Yes. There is room for improvement through web-based interactive programs.
The extent to which programmes are planned and approved through appropriate procedures	**X**			Done through the Research Council and approved by the BoG
The extent to which the availability of funds (government allocations and other funds) generating funds are taken into consideration in planning programmes	**X**			The available funds are generally not adequate to cover the planned project costs.
The obtaining of necessary equipment is considered in planning programmes	**X**			Yes. This is one of the main considerations.

Stakeholders are represented in the institution's planning and review committees.			**X**	Weak representation.
The extent to which socio economic and commercialization of aspects are considered in programme planning.		**X**		Implemented since 2009. However, this is somewhat in conflict with the original mandate but during the review period this has been given priority in programme planning
Effectiveness and efficiency of institutional procedures in approving new S& T programmes.		**X**		Moderate at present and can be improved further.

Additional observations (if any)

iii) Planning S& T / R& D Projects

A project is a set of activities designed to achieve specific objectives within a specified period of time. A project includes interrelated research activities or experiments, schedule of activities to be completed within a specific time period, budget, inputs and outputs,

focused towards intended beneficiaries. Projects are the buildings blocks of programes. For an institution to achieve its objectives, it is necessary for projects to be well planned in terms of their expected outputs, activities, and input requirements.

Management practice	**Level of Practice (Performance Indicators)**			**Comments/ Evidence**
	Strong	**Moderate**	**Weak**	
The staff is provided with guidance for project planning		**X**		General guidance is given. More focused guidance is needed. Not much evidence is seen.
Previous research results/data are used for planning projects		**X**		Yes. In projects which are continuing .
The extent to which the institution follows a formal process for preparation, review and approval of projects		**X**		Presently informal: Will be improved in line with ARF.*
The extent to which organizational plans (e.g. medium-term plan, corporate plan, strategy etc.) are used to guide project selection and planning		**X**		To a larger extent.
Multidisciplinary projects/ activities are encouraged by the institutions		**X**		Yes, strongly needs greater participation.

Foreign collaborations are encouraged and incorporated in planning.		**X**		Yes, whenever possible.
Partnership with private sector is encouraged by the institution	**X**			Yes, through CCD.**
The extent to which development research/activities are considered in planning projects		**X**		To a great extent, where relevant and depending on the nature of the project.
The extent to which basic research are considered when planning projects		**X**		To a great extent. Varies from project to project.
The degree to which adverse effects on environment are considered in planning projects		**X**		Implemented at project level.

* ARF = Agency Research Framework

** CCD = Consultative and Collaborative Division

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Additional observations (if any)

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iv) <u>Project management and maintenance of quality</u>

Proper project management and quality assurance/improvement practices are needed to ensure effective research operations, the quality of output and achievement of desired objectives.

Management Practice	**Level of Practice (Performance Indicators)**			**Comments/ Evidence**
	Strong	**Moderate**	**Weak**	
The effectiveness of the procedures for resource allocation at different levels (organization, departments, program etc.)		**X**		Satisfactory, but new projects need special consideration.
Ensuring that instruments, equipment and infrastructure facilities are sufficient for implementation of projects		**X**		Adequate, but new equipment need to be added especially when the new building comes up.

The effectiveness of administrative procedures and support for project implementation (procurement and distribution of equipment and materials, transport arrangements, etc.)		**X**		Adequate, but need to be streamlined further. Seems to be a bottleneck and needs to be more efficient.
Formal monitoring and review processes are used to direct projects towards achievement of objectives		**X**		Presently monitored through mid-year review process but needs to be improved.
The extent to which the researchers are supported by the required technical / field staff.		**X**		Satisfactory, and varies depending on the project.
Ensuring that established field / lab methods, and appropriate protocols are used		**X**		Adequate. The new RAs need an initial orientation & instrumentation training over a specific period when joined.
Rresearch projects/ S& T activities are completed within the planned time frame.		**X**		Variable and depends on external factors (funding, RA's etc.) Affected by high turnover of staff as well.

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.		**X**		Access to international journal database is limited. Should be resolved by NSF by organizing a multiple licence system on line for the national scientific community, as a whole.
The extent to which quality assurance practices are followed by the institutions		**X**		This is an area which needs to be strengthened by the Administration _ Board of Governors involvement is felt here
Ensuring that researchers/ scientists have access to computers and necessary software	**X**			Satisfactory.

Additional observations (if any)

v) <u>Human Resource Management</u>

Availability of an adequate number of qualified staff and effective management of human resources are key determinants of organizational performance. Establishing a cadre of qualified staff takes many years. To keep pace with new developments in science, technology, and management, it is also essential to upgrade staff regularly. Staff planning,

selection, recruitment, evaluation, and training are key components of human resources management that need to be in place for effective performance of an institution.

Management Practice	**Level of Practice (Performance Indicators)**			**Comments/ Evidence**
	Strong	**Moderate**	**Weak**	
The institution maintains and updates staff information in a database (including bio data, disciplines, experience, publications, projects)		**X**		Yes.
The institution, plans and updates its staff recruitments based on programme and project needs		**X**		As far as possible.
The effectiveness of the selection procedures and the schemes of recruitment		X		Effective.
Training is based on institution and program objectives and on merit,		**X**		Yes. The TAs and RAs need to get more training opportunities.

The effectiveness of the procedures in promoting a good working environment and maintaining high staff morale.		**X**		Yes. There is a visible need for greater integration among different categories of staff.
The effectiveness of staff performance appraisals		**X**		Satisfactory.
The effectiveness of rewards and incentive schemes in motivating the staff		**X**		Yes , There are opportunities to participate in national level schemes.
The effectiveness of managing staff turnover, absenteeism and work interruptions.		**X**		Satisfactory. Action needs to be taken to improve the morale and attitudes of the employees of I.F.S.

Additional observations (if any)

vi) <u>Management of organizational assets</u>

Organizational assets include not only staff buildings, equipment, and finances, but also include assets such as knowledge, technologies developed, intellectual property, and even credibility and reputation. A continuous effort is needed to protect all of these assets, because they are the basis for the sustainability of the institution and allow it to continue delivering quality research and service outputs.

Management Practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
The ability of the institution to carry out its mandate and the assigned statutory powers		X		Satisfactory.
Infrastructure (buildings, stations, fields, roads) is satisfactorily maintained.		X		Satisfactory, but additional funds are needed for improvement.
Vvehicles and equipment (lab, field, office) are properly managed and maintained.		X		Yes, but most vehicles and lab equipment are out dated.
The effectiveness of procedures to ensure that equipment are in working order		X		Satisfactory. New staff needs training in order to keep equipment in good working order.
The effectiveness of the institution's overall strategy in generation and proper utilization of funds		X		Overall utilization of funds is satisfactory

The extent to which the institution identifies opportunities for income generation and cost recovery		**X**		Not within the mandate of the IFS but partially realized through CCD. BoG should give a clear directive on this matter.
The extent to which the intellectual property rights of the institute are protected		**X**		No formal mechanism by the institute but achieved through the patenting process.

Additional observations (if any)

vii) <u>Coordinating and integrating the internal functions/ units/activities</u>

The planning and coordination of units (departments, divisions, committees, research stations, etc.) and interaction among them are often neglected and it affects the overall performance of the institution. The organization of these units and the overall structure need to be reviewed from time to time to ensure smooth and efficient operations. The planning and coordination of units, logistics, resources, and information flows are necessary to achieve integration and smooth functioning.

Management Practice	Level of Practice (Performance indicators)			Comments/ Evidence
	Strong	**Moderate**	**Weak**	
The extent to which institution is evaluated internally and restructured based on current needs		**X**		Implemented through Research Council and Board of Governors.
The effectiveness of internal communication and coordination mechanisms			X	Presently weak. Needs to be improved .
Institution's overall direction and coordination are provided by a central planning committee / unit.		**X**		By the Research Council and the Board of Governors.
The extent to which different units are assigned clearly defined functions		**X**		Satisfactory but not much integration among scientific & administrative units.
Responsibilities of research / management staff are clearly identified		**X**		Satisfactory. RAs depend on TAs heavily in some projects which is undesirable.

Effectiveness of using appropriate reporting procedures and feedback in management at different levels		**X**		Progress of Research Projects is reported quarterly, half yearly and annually. There should be a better

Additional observations (if any)

viii) <u>Partnership in managing information dissemination</u>

An important requirement of all S& T / Research & Development institutions is management of dissemination of technology and information to users. The partnership / linking up with other actors in Science & Technology and information system (including, universities, industries, private sector, international research organizations, extension, farmers etc.) promotes information exchange, collaboration, and cost sharing, and ultimately improves the quality and relevance of research.

Management Practice	**Level of Practice (Performance Indicators)**			**Comments/ Evidence**
	Strong	**Moderate**	**Weak**	
The institution systematically plans and performs dissemination of information		**X**		Yes. Can be improved further.

The extent to which the institution plans and maintains linkages with key partners for sharing and dissemination of information		**X**		Adequate .
The effectiveness of institutional procedures for technology transfer		**X**		Satisfactory.
The effectiveness of the system to obtain feedback from different types of stakeholders		**X**		Satisfactory.

Additional observations (if any)

Dissemination and Partnerships

ix) <u>Monitoring, evaluation and reporting procedures</u>

Monitoring (assessing ongoing S&T / research activities) and evaluation (evaluating the value, quality and results of research) are key management processes of public-S& T

institutions Monitoring and evaluation are also important for determining whether the institution is learning from its earlier achievements and failures. Monitoring, evaluation, and reporting procedures need to be properly designed (i.e. integrated into project planning and implementation) and periodically reviewed, in order to provide useful information for decision-making and accountability.

Management Practice	**Level of Practice (Performance Indicators)**			**Comments/ Evidence**
	Strong	**Moderate**	**Weak**	
The institution monitors and evaluates (M&E) its own activities periodically		**X**		Yes, through quarterly reports.
M&E is supported by an adequate management information system (MIS), which includes information on projects (e.g. costs, staff, progress, and Results).		**X**		Currently not supported by a MIS. Perhaps this is needed especially when outside funding is sought.
The extent to which S& T results and other outputs are adequately reported internally (e.g. through reports, internal program reviews, seminars).		**X**		Through quarterly Reports, Midyear Review and Annual Review
Eexternal stakeholders contribute to the M & E process in the institution		**X**		By mid-year and annual review and also through CCD

The extent to which the results of M&E are used for project/ research planning and decision-making.		**X**		Used as much as possible.

Additional observations (if any)

Annex VIII

Output Assessment

When assessing the output of an institution, the staff strength of that institution should also be considered. The major output categories are listed below. It is necessary for the reviewers to select relevant out puts from the table and feel free to add to this list where necessary.

a) Types of outputs

I. Technologies developed
II. Technologies transferred to industry / entrepreneurs
III. Information Dissemination / Extension
IV. Research Publications
V. Patents
VI. Services (Testing, Calibrations, Consultations, Advisory and etc.)
VII. Trainings
VIII. Others

b) Output measurements

This framework for output identification needs to be tailored to the activities of individual organizations. The panel should feel free to include additional outputs when necessary.

Output Category	Nos.	General Comments on quality and relevance of outputs and productivity of institution

1. **Technologies Developed** • New products / technologies • Improved products / technologies / laboratory methods • New planting materials / seed varieties	02	Improving the quality of drinking water and enhancing the crop productivity by introducing bio-fertilisers: These are relevant to the national development efforts of the country and saves foreign exchange to the country.
2. Technologies transferred to industry / entrepreneurs • Technologies developed locally • Foreign technologies adapted and transferred	02	Same as the above.
3. Information Dissemination / Extension ***Publications*** ▪ S & T institutional review reports ▪ Training manuals ▪ Advisory leaflets ▪ Newsletters ▪ Maps ▪ Posters ▪ Website in Sinhala ▪ Documentary Films ***Dissemination events*** ▪ Workshops and seminars ▪ Conferences	05 05 01 01 02 02	IFS plays a major role in dissemination of scientific knowledge at various levels through these activities.

▪ Exhibitions ▪ Media events ▪ Open days (educational visits to IFS) ▪ Demonstrations ▪ A/L Teacher Workshops ▪ A/L Teacher Training Programmes ▪ All island competitions for teachers ▪ School Science Programmes	03 16 06 04 02 03	
4. Publications • Research papers in ISI journals • Other research papers • Conference proceedings • Books and monographs • Chapters in Books • Books for G.C.E. O/L students • Technical reports • Consultancy Reports • Research reports	 58 02 02 08 03 03 04	As most of the publications are in ISI journals, the quality is of international standard.

5. Patents ***Individual*** • Local patents • Foreign patents (filed) ***Institutional*** • Local patents • Foreign patents	01	Only an application has been filed. No evidence yet for granting of the patent.
6. Services (Testing, Calibrations, Consultations, Advisory and etc.) • Policies developed • Reviews of S&T institutions • Research grants received and administered • Funding for training programmes and other S&T activities • Monitoring of research projects • Data bases developed • S&T surveys and maps • Science popularization activities • Environmental impact assessments • Instrument calibrations • Consultancy services • Testing and analytical services • Vaccines / seed production and distribution • Germ –plasm conservation • Recommendations in S&T matters	07	Total of over Rs 32 M has been received during the review period. Many of these activities are not applicable to the IFS. Relevant activities are commented previously.

7. Training ***Staff training programmes*** • Local (For Technical Officers) • Foreign ***Training programmes for stakeholders*** ***Postgraduate Training*** Ph.D. M.Phil.	01 02 07	Since there was an increasing trend of output of postgraduate degrees from 2009 t0 2011, more output is expected beyond 2011.
8. Awards Presidential awards for Research (No. of researchers) Research Fellowships Awards for RA's	06 03 02	These are international awards given on competitive basis.

- Total S & T staff strength of institution Total of 50 in 2011 (15 Ph.D., 01 M.Phil., 04 M.Sc., 30 Basic degree)

- Comments on productivity of institution based on outputs and S & T staff strength

  - Scientific staff with higher post-graduate qualifications constitutes only around 20 - 25% of the S & T cadre during the review period and their overall collective performance in realizing this selection of the mandated objectives appears to be satisfactory despite prevailing constrains.

- Winning several national and international awards/fellowships/grants as well as the research output displayed by way of an impressive list of publications are creditable achievements of the Institute in keeping with its aims and objects.

- The presence of a) about 30 graduate research assistants which is about 40% of the S&T cadre of the Institute, b) the full cadre of technical staff and c) also the cohorts of volunteers joining from time to time together form a valuable human resource pool. The review panel is of the opinion that this resource pool could be more beneficially utilized by the senior scientific staff than done at present to the strategic advantage of the institutional performance.

Annex IX

SUMMARY OF THE INSTITUTION'S CONTRIBUTION TOWARDS THE FOLLOWING OBJECTIVES

Objectives	Institution's contribution†
1. Promoting the use of S&T to achieve rapid economic development, improve the quality of life and alleviate poverty.	(Moderate)
2. Involving scientists & technologists in the formulation of policy & decision-making.	(Moderate)
3. Fostering S&T to develop self-reliance and to ensure the allocation of a reasonable proportion of GNP for S& T activities.	(Weak)
4. Development of Indigenous technology	(Weak)
5. Importation, adaptation and assimilation of technology for rapid growth in industry, agriculture and services.	(Weak)
6. Production and retention of scientists, technologists and technicians of high caliber and competence.	(Moderate)
7. Providing opportunities for all persons to acquire basic education in Science and its applications and inculcating the importance of science, scientific methods and	(Strong)

technology among them.	
8. Disseminating the benefits of S&T activities to all sectors.	(Moderate)
9. Strengthening Science & Technology cooperation among Scientists & Technologists of Sri Lanka and those abroad to access global knowledge	(Moderate)
10. Capability of continuously planning, evaluating, reviewing S&T activities and identifying and promoting priority areas that are likely to be of benefit to Sri Lanka	(Moderate)

†Although this is not relevant to mandate IFS has carried out some work promoting economic development and poverty alleviation.

ANNEX X

Photographs of Instititutional Review Activities

Left; Prof. CB Dissanayake welcomed the Review Panel and giving an overview of the activities of IFS, to the Review panel.
Right; Dr. Muditha Liyanagedera (Acting Director- NASTEC) explain the objectives of the Institutional review of IFS and review procedure to the IFS staff.

Left; Review Panel - Prof. IAUN Gunatillake, Prof. Anura Wickramasinghe, Prof. Sisira Pinnawala Prof. BSB Karunaratne and Dr. Jagath Gunatilake. Right; Explaining the objectives of the Institutional review of IFS and review procedure to the IFS Research Project Leaders.

Left and Right; Senior Scientists/Project Leaders explaining their research projects to the Review Panel


Left; Explaining the objectives of the Institutional review of IFS and review procedure to the IFS staff – Project leaders.
Right; ; Explaining the objectives of the Institutional review of IFS and review procedure to the IFS staff – Research Assistants


Left; Explaining the objectives of the Institutional review of IFS and review procedure to the IFS Administrative Staff.
Right; RAs explaining their concerns to the Review Panel.


Left; Explaining the objectives of the Institutional review of IFS and review procedure to the IFS Technical Staff.
Right; Review Panel - Discussion with the Assistant Librarian regarding the usage of library facilities.


Left and Right; Observation of the NASTEC Review documents by the Review Panel in the IFS Library.


Left; Meeting of the Review Panel with the Administrative Staff of IFS

Left; Meeting with the IFS Coordinator – Dr. Kumari Thilakeratne – Discussion about the IFS web site and "*Vidu Mang Petha"* compiled by her. Right; Display of IFS activities including the details of *"Vidu Mang Petha"*

Left and Right; Laboratory visits of the Review Panel – Discussing about the analytical facilities available and the difficulties the scientific staff (RAs) undergo.

Left; Laboratory visits of the Review Panel – Right; IFS Reception and telephone exchange.

Left and Right; Laboratory visits of the Review Panel – Discussing about the analytical facilities available and the difficulties the scientific staff (RAs) undergo.

Left and Right; Laboratory visits of the Review Panel – Discussing about the analytical facilities available and the difficulties the scientific staff (RAs) undergo.

Left and Right; Laboratory visits of the Review Panel - Explaining the research outcomes and publications to the Review Panel.

Left; Laboratory visits of the Review Panel - Explaining the research outcomes and publications to the Review Panel. Right; Some posters submitted to National and International conferences


Left; Visit of the Review panel to the Green House Right; Explaining the outcome of the Rizobium Project and the commercialization procedure.


Left and Right; Laboratory visits of the Review Panel - Explaining the research outcomes and publications to the Review Panel.


Left and Right; Visit of the Review Panel to the IFS Workshop – Explaining the activities of the technicians for IFS research projects.

Left and Right; Review Panel visit the Administrative Office of IFS.

Left; Review Panel visit to the Finance Division - Getting information on the problems of ordering equipment and chemicals etc.

Left & Right; Meeting with the Senior Scientists to summarize the observations of the Review Panel.

Left; Meeting with the Trade Unions of IFS Technical staff.


Left and Right; Meeting of the Review Panel with the NASTEC Chairman and IFS Stakeholders at NASTEC Office in Colombo – NRC, NSF and Nature's Beauty Creations Ltd. etc.


Left; Visit of the Review Panel to the IFS Colombo Office. Right; Interior of the IFS Colombo Office (just after NRC shifted their office to a different place)


Left; Visit of the Review Panel to the IFS Colombo Office – meeting with the Officer In-charge.
Right; In-front of the IFS Colombo Office – Twin house