INSTITUTIONAL REVIEW OF THE NATIONAL SCIENCE FOUNDATION (2017-2019)

PREPARED FOR
NATIONAL SCIENCE &TECHNOLOGY COMMISSION

A Report Prepared for the
NATIONAL SCIENCE AND TECHNOLOGY COMMISSION

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Authored by –

Prof. Manjula PS Magamage
Prof. Theodore Feranando
Mr.Shantha Weerasinghe

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Abbreviations

BOM	Board of Management.
CEO	Chief Executive Officer
CKDu	Chronic Kidney Disease of unknown etiology.
COVID-19	Corona Virus Disease
DAAD	German Academic Exchange services
ECG	Electro Cardio Gram
ERP	Enterprise resource planning
HARTI	Hector Kobbekaduwa Agrarian Research & Training Institute
HOD	Head of Divisions.
IBSL	Institute of Biology of Sri Lanka
ICTA	The Information and Communication Technology Agency
IESL	Institution of Engineers of Sri Lanka
IKD	Information and Knowledge Division
ILD	International Liaison Division
IESL	Institution of Engineers of Sri Lanka
IES	Education, and the Institute of Engineers
IPSL	Institute of Physics of Sri Lanka
IACUC	Institutional Animal Care and UseCommitteese
IP	Intellectual Property
IPSAT	International Partnerships for Science & Technology
ISO	International Standards Organization
JNSF	Journal of the National Science Foundation
JPD	Journal Publishing Division
JST	Japan Science and Technology Agency
M & E	Monitoring & Evaluation
MIS	Management Information System
MODA	Microbial Oxidative Degradation Analyzer.

NARESA	Natural Resources, Energy & Science Authority
NASTEC	National Science and Technology Commission
NIE	National Institute of Education
NLDB	National Livestock Development Board
NRC	National Research Council
NSC	National Science Council
NSF	National Science Foundation
NSLRC	National Science Library and Resource Center
NTRP	National Thematic Research Program
OSTP	Overseas Special Training Program
QA	Quality Assurance
RD&I	Research, Development & Innovation
R&D	Research Division
SCI	Science Citation Index
SDG.	Sustainable Development Goals
SLAAS	Sri Lanka Association for Advancement of Science
SLJSS	Sri Lanka Journal of Social Sciences

Acknowledgements

The Review Panel appreciates the confidence placed in them by NASTEC and acknowledges the guidance given through the Review Manual. The support provided by Senior Prof. Kshanika Hiriburegama (Chairman) Mrs. Nazeema Ahamed (Acting Director) and Ms. Rasitha Perera (Scientist) is especially appreciated.

Amid COVID-19 waves shattering around the country, lockdowns, restrictions for meetings, and limitations for physical gatherings have made us take quite a long time to complete this review. The efficient planning and coordination of all Review Activities, with meticulous attention by Ms. Rasitha Perera (Scientist), was indispensable in the successful completion of this review. The Review Panel acknowledges her contribution with gratitude.

Prof. Ranjith Senarathne (Chairman, NSF), Mrs. Thamara Dias (Acting Director-General, NSF), and all the staff of the NSF co-operated with the panel to complete the Review, without reservation. We acknowledge their co-operation gratefully.

Former Chairman/Chairperson and some members of the former Board of Management graciously agreed to meet us and exchange views and provided us insights which were invaluable in arriving at our judgment.

A wide selection of Stakeholders of the NSF from the Scientific and Academic community, the Ministry of Education, and a few from the industry and general public participated in a lively Stakeholders meeting and gave us their frank feedback which helped us to view the performance of the NSF in perspective. We are thankful to them.

Executive Summary

The Science and Technology Development Act No.11 of 1994 mandates the National Science and Technology Commission (NASTEC) to review the progress of Science and Technology Institutions in respect of goals and objectives identified for each Institution.

The National Science Foundation (NSF) is a state-funded Statutory Institution that operates within the purview of the Ministry of Technology & Research (previously Science and Technology). It is mandated to: initiate, facilitate and support basic and applied scientific research by universities, Science and Technology Institutions and scientists with a view to; strengthen scientific research potential including research in social science and science education programmes; develop natural resources in Sri Lanka; promote the welfare of the people in Sri Lanka; train research personnel in science and technology; foster interchange of scientific information among scientists in Sri Lanka and Abroad; award scholarships and fellowships for scientific study or scientific work at recognized science and technology institutions; maintain a current register of scientific personnel and in other ways to provide a central clearinghouse for the collection interpretation and analysis of data on the availability of, and the current and projected need for, scientific and technical researchers in Sri Lanka, and provide a source of information for policy formulation on scientific technology and other fields, and popularize science amongst the people by funding and executing programs for the purpose.

NSF was established in 1998 and is the successor to National Resources Energy and Science Authority (NARESA) established in 1981 as the successor to the National Science Council (NSC) established in 1968. An independent review panel consisting of three members was appointed by NASTEC in consultation with the NSF to report on the progress of NSF from 2017 to 2019. The Review was conducted as per guidelines stipulated in the Review Manual published by NASTEC. The Review was conducted from August 2020 January to May 2021. This Review process was subjected to many drawbacks during COVID-19 waves, the First Wave was reported from March 2020 to 2020 August while Second Wave was from November 2020 to 2021 February and the current COVID Wave was the April wave from 2021 to date as of 31st May 2021. The main objective of the review was to assess how effectively the NSF has acquired and utilized resources to generate and implement programmes consistent with its Mandate and to provide outputs that are relevant to its stakeholders and national development goals. Subsequently, the Review focused mainly on the specified time period identified by NASTEC 2017 –2019. The Review process viewed the evolution of the NSF throughout periods of inception and its future direction as envisaged in the Corporate Plan (2017 –2020). Subsequently, the present review team appointed has prepared and submitted this report NASTEC for years 2017-2019 in mid-2021. The review commenced with the careful perusal of the self-assessment report provided by the institution. On the first day of the Review, this was complemented by a comprehensive presentation by the Chairman and Director NSF which gave an insight into the future direction of the NSF under the newly appointed Board of Management.

The Review continued with several subsequent visits to the institution where all the divisions were visited and separate discussions were conducted between the panel and staff of each division.

Subsequently, the panel had a half-day interaction with a wide range of Stakeholders of the NSF where a frank discussion ensued through the zoom virtual platform. After a meeting with representatives of all parties the panel also met the Chairman and a few members of the Board of Management (from 2017 to 2019) informal manner. This meeting gave the panel an insight into the rationale of the policies and programmes implemented and some reasons for their success/failures. This Review was very extensively dragged due to the COVID-19 situation with limited participation and restricted meetings arranged in accordance with COVID preventive guidelines. But the Review team ensured that they had addressed an impartial evaluation during this volatile situation both in and out and delivered the best suitable opinion about the SAR report and the progress made by NSF during this assessed period 2017-2019.

The professional opinion of the panel was arrived at by the guidelines given in the Review Manual developed by NASTEC. It was based on a detailed assessment of the management practices and a critical evaluation of its outputs about the available physical and human resources. The panel perused a large number of relevant documents to complement and confirm the information obtained by discussion and observation. The panel made due allowance for the strengths and constraints of the political and economic context within which the institution functioned.

The consensus opinion of the panel is that in the above-mentioned context the NSF has fulfilled most of the expectations given in the mandate. The Panel feels that there has been a progressive improvement in performance over this period despite the sudden turbulence situations and economic setbacks, as a whole the NSF has gained the confidence of a large majority of its Stakeholders in the scientific and academic community and the education system.

Despite huge discrepancies over the internal carder positions as well as promotional schemes, progress made during the period of Review is commendable. Despite relatively modest remuneration and incentive package in comparison with comparable scientific institutions, the staff has been more than adequately productive and protectively engaged in their respective spheres of activity. From our observation, there can be further improved performance, improvements in the areas of income generation, management of digitalized library information systems, and, technology transfer. However, they have to be mindful of the ex-Auditor General's Report. "NSF is expected to give its services to the public free of charge and cannot charge money from service recipients". Maybe time is ripe to think anew and make provisions in the existing mandate to introduce changes. The few areas in which there is room for improvement are dealt with in the detailed comments and recommendations. Few management practices that need improvement too are addressed.

The major objective and outcome of the NSF has direct relevance to the National development goals and is consistent with the objectives of the National Science and Technology policy. The panel thinks that greater allocation of resources and their timely disbursement would further, enhance its productivity and contribution to national development goals while having considering research commercialization initiatives as well as link goals of "Vistas of Prosperity" introduced by the present government in (2019) into their action plan may be fulfilled for the future needs of the country.

1.0 Introduction: Overview of the National Science Foundation

History

The National Science Foundation (NSF) was incorporated in 1998 under the Science and Technology Development Act No.11 of 1994. NSF is a State-funded Institute and is the successor of the National Science Council (NSC)–1968 and was an extension of Natural Resources, Energy and Science Authority (NARESA) –1981.

NSF is mandated to serve and strengthen the Science and Technology sectors in Sri Lanka, performs its tasks by the functions set out in the Act and its activities conform to the National Science & Technology Policy. Accordingly, the NSF facilitates research, development, and innovation to create a knowledge economy. It also facilitates funding, especially for capacity building, infrastructure development, technology transfer, knowledge creation, sharing of knowledge in all fields of science & technology to improve the quality of life of the people, and also popularization of science among school children, teachers, and parents envisaging a knowledge society.

Its functions, as specified in the Act, are as follows

a) To initiate, facilitate and support basic and applied scientific research by universities, science and technology institutions, and scientists, with a view to:

   i. strengthening scientific research potential, including research in the social science, and science education programs;
   ii. developing the natural resources of Sri Lanka;
   iii. promoting the welfare of the people of Sri Lanka
   iv. training research personnel in science and technology.

b) To foster the interchange of scientific information among scientists in Sri Lanka and abroad.

c) To award scholarships and fellowships for scientific study or scientific work at recognized science and technology institutions.

d) To maintain a current register of scientific and technical personnel, and in other ways to provide a central clearinghouse for the collection, interpretation and analysis of data, on the availability of, and the current projected need for, scientific and technical resources in Sri Lanka, and to provide a source of information for policy formulation on science, technology, and other fields, and

e) To popularize science amongst the people by funding and executing programs for the purpose.

The vision of the NSF

"To be the nation's premier driving force in promoting Science, Technology & Innovation the or economic and social prosperity of Sri Lanka.

The mission ***of the NSF***

Initiate facilitate and support research, development, innovation, and technology transfer through funding, knowledge creation, capacity building, partnerships, information dissemination, and popularizing science to create a knowledge-driven society and economy, efficiently and effectively, and contribute to improving the quality of life and standard of living of our people whilst nurturing a competent staff and ensuring transparency, accountability, fairness, equity and principles of sustainability.

The Corporate Goals

Six goals have been identified in the Corporate Plan of the NSF 2013-2017 and 2018-22 based on its mandate.

- Goal 1: To be the premier organization to promote RD&I, S&T capacity building, and be a partner in promoting natural resources conservation and utilization for sustainable development of the country.
- Goal 2: To be the leader in the facilitation of technology development and transfer and to emerge as the eminent catalyst for RDI commercialization.
- Goal 3: To be the focal point to collect, collate, analyze, interpret, store, disseminate and provide access to STI information.
- Goal 4: To be the leader in the popularization of STI amongst the general public and partner in promoting science education.
- Goal 5: To be the key gateway for the international liaison of the STI community.
- Goal 6: To be the leading RD&I funding organization with improved governance, management, and competent scientific, administrative, technical, and support staff.

Governing Ministry

NSF functions under the purview of the State Ministry of Skills Development, Vocational Education, Research & Innovations. During the period under review, it was the Ministry of Science & Technology.

Sources of Funding

NSF is a Government-owned statutory board that receives the annual capital and recurrent grants from the Government Treasury. A very small portion of funds is generated internally mainly from the sale of publications. A small percentage of funds for specific projects have been received from International Organizations.

Organizational Structure

NSF is governed by the Chairman and the Board of Management (BoM). The BoM decides on the policies and the Director-General as the chief executive officer coordinates the activities. NSF has a total of 109 employees as of 31st March 2021 out of which 37 are science and technology personnel, 15 administrative staff, 8 are technical staff and 49 are supporting staff.

The organization has eight Scientific Divisions: Research Division, Technology Division, International Liaison Division, Science & Technology Policy Research Division (STPRD), Science Popularization Division (SPD), Journal Publication Division and National Science Library and Information Centre, Thematic and Special Project Unit and five supporting Divisions: Administration, Accounts, Internal Audit, Information Technology, and Administrative and Finance Division

2.0 Procedure Adopted for the Review

An independent panel comprising of three members appointed by the NASTEC in consultation with the NSF carry out the Review. The Panel members were –

Prof. Manjula PS Magamage (Chair) – Chairman, National Livestock Development Board. Colombo 05. Dean, Faculty of the Agricultural Sciences Sabaragamuwa University of Sri Lanka.

Prof. Warnakulasuriya Theodore Alexander Fernando –Professor, Faculty of Humanities and Social Science, Open University of Sri Lanka

Mr. Shantha Weerasinghe – District Secretary/Government Agent, Galle, Ministry of Home Affairs & Public Administration, Home Affairs, Provincial Council, and Local Government.

The panel was formally informed about the Review procedure at a meeting held on the 19th July at NASTEC by Prof. Khanika Hiruburegama Chairman/NASTEC and subsequently by. Mrs. Nazeema Ahamed Acting DG NASTEC. The Review was based on the guidelines given in the Review Manual prepared by NASTEC.

The review panel made several visits to the NSF for the acquisition of information concerning the responsibilities of the NSF. Given below is the description of visits made by the review panel:

1. 1st August 2020: 1stvisit to the NSF – Chairman of NASTEC and the Review Panel meeting with the Chairman, NSF, the Director-General of NSF, and Senior Officers. The presentation by the Director/NSF, Meeting with the Technology Division (TD), Observation of facilities of the division;

2. 8th August 2020: 2ndvisit to the NSF – Meeting with the Research Division, The Science Popularization Division, and Science & Technology Policy Research Division, Observation of the facilities of the divisions;

3. 22nd August 2020: 3rd visit to the NSF – Meeting with the Administrative Division, Accounts Division, Internal Audit Division, and the Science Library & Resources Center, Observation of facilities of the divisions;

4. 10th October 2020 (Morning): Meeting with the Stakeholders of the NSF, through Zoom Platform. The meeting was well attended by representatives of Stakeholders via; representing universities, research institutes, private organizations, the school sector and business enterprises from all levels in terms of seniority;

5. 10th October 2020 (Afternoon) 4th visit to the NSF–Meeting with the Printing Unit and the IT Unit;

6. 10th October 2020 (Afternoon): Discussion with Trade Union Representatives;

7. 3rd December 2020 Zoom Meeting with the members of the Board of Management of NSF during the period 2017-2020. Board members including, Chairman Prof. Ranjith Senarathne was attended. Further in-person consultations were made with Dr. Thamara Dias, Prof. Ananda Jayewardene (Former Vice-Chancellor, University of Moratuwa/ Member of the UGC Commission), and Prof. Thakshila Serasinhe Senior Professor, Department of Animal Science, Department of Agriculture, University of Ruhuna. Due to the COVID-19 waves, the Review Panel faced many practical difficulties for arraigning in-person meetings with previous Boards of Management. Most of the consultations were obtained over the mobile and Zoom platform.

8. 25th January 2021 final meeting with NSF staff and other members from the ministry to obtain feedback for the Draft Review Report to be submitted by the Panel.

The panel perused quite a large number of documents (See Annexure) made available by the NSF and a few more were provided on request. As specified by the Review guidelines, information gathered during visits and meetings along with information by the perusal of all relevant documents including the self-evaluation report prepared by the NSF and the corporate plans were used by the Review Panel to assess the outputs of the institution and its management processes and to finalize, a judgment of conclusion about its performance Where ever possible the information was triangulated to establish its veracity. On the last day, there was a debriefing with the Director-General of NSF in order to clarify doubts.

Ms Dilini Jayaweera Scientific Office from NSF and Program Manager of NASTEC made valuable assistance to the Review Panel by coordinating the number of visits to NSF, arranging meetings, and making relevant documents available during the entire course of the Review process.

The Review Report was prepared in a participatory manner by all three members of the panel. Although different sections were written by different members all collectively viewed the final document and there was complete consensus on all the opinions and conclusions in the report. The panel takes collective responsibility for the Report.

Commentary on Management Assessment

The Review Manual formulated by the NASTEC indicates nine management aspects and each aspect is further supported by a number of salient statements which are applicable to S&T institutions, in general, and in this case, almost all are applicable to the NSF. Below we summarize the key points identified by the Review Team.

3.1. Assessment of Institutional Response to External and Internal Environment in Planning Organizational Strategies

The Review Panel found that the NSF has formulated comprehensive corporate plans covering the periods 2017-2019 and beyond and which clearly elaborate the **Vision**, **Mission**, **Specific Objectives,** and **Strategic/Action** Plans. Further, it is observed that these strategies are sufficiently aligned with the Government policies and development goals and consistent with its organizational mandate. The top management, the Board of Management, and the senior staff have been directly involved with the formulation of such plans/policies, and the two plans confirm continuity and have been updated annually, as appropriate, i.e. on an assignment and rolling basis.

However, it looks as though the planning process has adopted a largely top to bottom approach but consultation with the lower grade staff had been minimal. As far as we could ascertain there had not been a formal consultation with a wide group of stakeholders, the stakeholder input had come mainly from those actively and involved in the various committees and panels.

In spite of a fairly down-to-earth SWOT analysis, not all the threats identified have been adequately addressed in the strategic planning. The most important fact is that the near-total dependence on state funding and the erratic nature of its disbursement by the Treasury has been recognized but no attempt has been made to plan innovative approaches to generate funds or adequately mobilize all potentially available sources of funding. Improvements are needed in research commercialization and making them marketable, though not totally ignored, considerable attempts were noted but were not that significant for overcoming the huge economic crisis NSF is facing. There is a tacit acceptance that being a 'service organization' they need to depend on state funds. There is some evidence that policies are reviewed intermittently and the plan updated as needed based on both internal and external factors. It is noteworthy that ministerial-level administration support should efficiently be maintained for further improvement of the current fate of NSF. Longstanding workforce promotion and status issues cannot be resolved overnight but more attention from all segments will be helpful to achieve the institutional response to gain team spirit for further success. Most of the researchers and recipients that we were able to interview as a panel, through Zoom technology affirmed and highlighted some of the points that NSF staff has noted in their SWOT analysis done by them and given to us, namely "inability to obtain allocated funding fully and timely". Most of the researchers while sharing explained the immense problem of obtaining grants on time. It led to

constraints such as research assistance leaving abruptly, PhDs getting delayed, and recipients getting demotivated. Since most of the funds distributed and reimbursed to individuals working with universities, government institutions, and private firms, are delayed in getting, maybe NSF should have a mutual agreement with some of the leading banks to advance the money with a guarantee of reimbursing later. Maybe government banks would be willing to advance the money for the approved research proposals by NSF with a guarantee of repayment. As a panel, we also felt that it is high time to revise and update some of the financial regulations that encourage those shortcomings mentioned in NSF's SWOT analysis were also stressed by almost all the people who participated in our panel discussion. "Science population-focused only on a limited audience of pre-selected schools and universities, limited group applying and getting grants and other benefits, the paucity of application especially for technology grants, traditional not environmentally friendly paper-based operational system leading to wastage and unwanted delays".

3.2 Planning S&T Programs and Setting Priorities

The Review Panel observed that both National Development Goals and Stakeholder interests are taken into account adequately in S&T program planning. This is because NSF is almost exclusively dependent on government funding and alignment with government policy objectives becomes a necessity. However, there is room for improvement in prioritizing programmes based on national needs. For an instance new visionary thinking of programmes to address long-standing problems in the country such as research commercialization, CKDu, or pollution due to industrial waste. Delayed responses from research organizations will not benefit the country. Institutions must always think to step ahead of policymakers and so on. The new initiative of thematic multidisciplinary research does address the issue of prioritizing to some degree. There has been a tendency over time, especially in the research directed towards a post-graduate degree to address conventional problems to a large extent. Therefore, concerning "setting priorities", care must be given to revise these programs regularly to make them more relevant to national needs. In Sri Lanka, NSF is one of the major Research Funding Institute for the limelight, sharing seventeen Sustainable Development Goals (SDG) with their setting priorities proposed. Of course, it is understood that NSF's annual action plan has been prepared taking into consideration government priorities envisaged in "Vistas of Prosperity" (2019) as well as SDGs.

The need for an identified list of National Research Priorities to guide potential researchers was highlighted by some stakeholders. However, we noted that the National RD&I Framework for 2015-2020 which was published after the BICOST VII Was adopted by the NSF when setting its, research priorities. Whether this falls within the purview of the NSF or more appropriately the NRC or SLCARP has to be decided. Stakeholder interests are addressed adequately in programme planning, as a wide but carefully selected cross section from the scientific community is well represented in the advisory panels and review committees. However, representation of the Lay Public who are also Stakeholders is limited and the corporate sector's participation is minimal.

The programmes are planned and approved through correct procedures and the availability of funds from the state or in a few instances from other sources have been taken into reckoning. Most of the Stakeholders are satisfied with the efficiency of procedures for approving programmes and projects, but some feel that there is a need for further improvement. The panel notes favorably recent initiatives to standardize and shorten the Review Process. Minimal participation of the corporate sector/entrepreneurs in the planning process has resulted in inadequate consideration of the commercialization potential of program/project outcomes. Also digitalize proposal submission format, online review formats and user- friendly improvements in online systems were suggested by many Stakeholders.

The Divisions responsible for S&T research are seen working towards achieving the intended targets, within their human and physical resource capacities. Greater coordination of these efforts at the senior management level may improve the efficiency and effectiveness of these programmes. The Review Panel notes with approval the revised organizational structure which delegates the coordination of the scientific and research programs to the Additional Director.

3.3 Planning S&T / R&D Projects

It was observed that the NSF follows a formal procedure for preparing, the review, and approval of projects, thus, there exists a minimum opportunity for ben bias. The process is known to the Stakeholders, should be more transparent once, published on its website. Multidisciplinary research projects are encouraged, though only a few such projects have been implemented during the past few years due to other constraints including resistance from individual researchers. The recent addition to the National Thematic Research Program (NTRP) is viewed positively. Its aim is to make several research groups addressing a higher (NTRP) is to bring and converge outputs of all research groups bringing solutions priority concerns, and one of the objectives of the newly established unit is to find solutions to burning problems and implement them at field level.

NSF has consistently supported basic research and continues to do so. The scientific community in the universities and research institutions have strongly acclaimed the NSF's role in capacity building. NSF grants in the early stage of a scientist`s career fund mostly basic research projects often directed towards obtaining a post-graduate degree. At the stakeholders meeting several eminent and productive senior scientists gratefully acknowledged NSF`s role in their own careers and in adding to the national pool of researchers. The review panel views nationally relevant basic research as a prerequisite for applied research and strongly endorses the recent policy decision that at least 40-50% of research funding disbursed by the NSF should be directed to basic research.

Several Research Advisory Committees are established to oversee the planning, approving, implementation, monitoring, and evaluation of research and development activities, and they are functioning satisfactorily. Although foreign collaborations are encouraged only a few projects have managed to achieve this and even in these projects the foreign contribution has not been utilized to the best potential.

One of the major weaknesses identified is that the NSF does not make adequate efforts to involve the Private Sector in Research Activities. Although its Policy Statements encourage it, there is a failure to adopt appropriate innovative strategies to harness the Private sector and their input. However, in the recent past, there have been some initiatives to have collaborative programmes to support entrepreneurship, innovative research, and development. The commercial potential of completed applied Research Projects has not been fully realized due to deficiencies at the level of project approval, and ineffective monitoring and evaluation of final product on completion.

The affiliated ministry of NSF at present is more suitable for strengthening the Technology Transfer Initiatives. The technology transfer rate at present is modest at best, and it appears that with appropriate policy and procedures it can be strengthened substantially. Environmental concerns are adequately addressed in planning and procedures for project approval. Clearance from the relevant regulatory agencies is mandatory for projects where such concerns are relevant.

3.4 Project Management and Maintenance of Quality

The effectiveness of administrative procedures for resource allocation at different levels of the NSF was seen to be quite satisfactory. Given the regular budgetary constraints, the NSF has taken steps to maintain its stock of equipment and other infrastructure and utilize them for effective project administration.

Although individual staff/divisions adopt various mechanisms to assure and upkeep the quality of their work, there is no formal quality assurance system in place at present. We note favorably that a time-bound process for obtaining ISO9001:2008 certification has commenced and all staff has been made aware of the concept of quality assurance. The Review Panel is in view that it is deemed to be necessary to initiate an internal quality assurance unit/cell under NSF subsequently it also can serve as a strategic management plan committee as well. This would provide a wider space for interacting with top management for decision-making process through the bottom-up approach along with middle-level management staff. We are of the view that middle-level management staff should be provided with wider room for discussion and knowledge sharing as they are the ones who are in direct contact with various Stakeholders.

It is clear that national procurement guidelines had been followed appropriately. The NSF procedures for procurement and logistics seem satisfactory. However, there is a pool of vehicles and drivers for transport which is not adequate for the essential functions.

There is formal monitoring and reviewing of all projects using a structured format and researchers are adequately supported in this respect by NSF staff. Although there is no field staff in the NSF, in the past field supervision of projects was done as required. The increase in the number of projects with transport facilities remaining the same has made this practice a rarity at present. Increasing vehicle pool and associated staff probably be a further burden to the overburdened national budget. Therefore, procurement of hired vehicle pool system will be a viable alternative for overcoming the vehicle issue.

The huge inadequacy of office spaces for each division results in the workspace for individual staff being rather cramped and ergonomically sub-optimal. This also compromises individual privacy and confidentiality.

Only a few have access to computers and necessary software and the internet to work on their day-to-day functions. It would be desirable for these essential facilities to be equally extended to all staff based on need. NSF administration has to take reasonable measures for its staff, as a whole, and the scientists and researchers who utilize its services to have free and unfettered access to scientific information, journals, databases, library facilities, and the internet.

Research projects are rarely completed within the planned time frame due mainly to factors beyond the control of the NSF. These unavoidable delays are mainly due to the disbursement of funds by the Treasury and logistic constraints in the host institution. Occasionally lack of specialized staff in the NSF and undue delays by external reviewers prevents completion of project work on the stipulated time. Present STMIS database is a good initiative for gathering the relevant scientific staff in various disciplines under a single pool. More attention from top management is necessary for regular updating of such database which is mandatory and sufficient staff should be allocated for timely completion of these activities.

3.5 Human Resource Management

NSF possesses a satisfactory staff selection and recruitment procedure that is transparent and equitable. The recruitment is done primarily on merit and there is very little political interference in the process. The staff in general and the scientific staff in particular, work enthusiastically despite a relatively modest remuneration package. They seem to derive significant professional satisfaction from their work. There is a good working environment within the institution and the relations between all categories of the staff seem to be cordial, the limited resources being shared relatively equitably.

Personalized raw data files are available for all staff. However, there are no database files and updates where all relevant information about staff is easily accessible while safeguarding also their confidentiality. The IT capacity needed for this purpose is available and this should be considered an essential prerequisite for effective human resource management. Digitalized HR management system or ERP, the total solution is suggested to overcome these issues and further strengthen HR management tools.

The institution takes into account the needs of each division in its attempt to recruit staff for its programs and projects but has not been completely successful in this respect due to various constraints including the need for strictly adhering to DMS guidelines regarding qualifications etc. Some lateral thinking and discussion with the relevant authorities on how to overcome these constraints in filling essential cadre vacancies seem to be an urgent need. The overall remuneration package according to a majority of the staff is low in comparison with equivalent scientific institutions. The root causes of inadequate remuneration should be studied and remedied to motivate the staff. The medical cover provided is grossly inadequate. There are no financial incentives as the institution does not generate any funds on its own.

Despite the above, compared to other similar institutions, there is low staff turnover, absenteeism, and work interruptions within the NSF. There are only 35 vacancies in a total cadre of 144. The staff needs to be commended for their dedication in this context.

Although the staff has had a variety of training opportunities both local and foreign, they were not planned, based on a training need analysis. The training provided, largely locally, has been opportunity-based rather than need-based. There is a need to carry out performance appraisals regularly to understand the training needs. It would further motivate the staff and increase their efficiency. There should be more opportunities for research staff to pursue higher degrees towards M.Phil. or Ph.D. There is little incentive to do so as obtaining such qualifications count very little for promotions or pay. The root causes of this problem should be analyzed carefully and steps should be taken to address the problem pro-actively.

3.6 Management of Organizational Assets

Infrastructure and Services:

The existing buildings, fields, and roads within the premises are satisfactorily maintained. The reception area is well planned and gives a good first impression and a good ambiance about the working environment. However, space limitation is a major constraint in carrying out its mandated activities. The vehicles and equipment appear to be properly managed and maintained. Most of the equipment used in the office is well serviced the staff ensures that they are maintained in good condition. IT unit supports the staff in the best way possible and the available facilities are mutually shared in many Divisions.

***Funds*:**

NSF has to depend on treasury public funds for all its activities, including capital and recurrent expenditures for projects, programs, and internal administration. There is a failure to identify potential sources of private funding or means to generate its own income. Even cost recovery is not considered to be feasible in respect of its publications. This aspect as indicated earlier is not sufficiently addressed in its strategic/activity plan.

The procedure used to allocate financial resources obtained from the government is based on annual plans, but every division does not get its targeted/proposed amount to carry out its intended activities. The limitation of activities is attributed to insufficient staff and limited treasury allocation and disbursement. It would therefore be desirable to actively explore alternate funding opportunities, especially in the areas of research and development, and technology transfer.

Utilization of the funds made available is done in an efficient manner addressing program and project needs. After making allowance for the erratic disbursement patterns of the treasury almost full use is made of the allocated funds.

3.7 Coordinating and Integrating the Internal Functions/Units/Activities

The NSF has a clear and formidable organizational structure which indicates the paths for communication and reporting. The Board of Management (BOM) is the governing authority. It decides on policy and provides advice and support to the administration of the NSF. It meets once a month. The Chairman of BOM and the Director General (Acting) of NSF work mutually for benefit of the institution.

The Director-General is the CEO and chairs the Senior Management Committee (SMC). The Heads of Divisions (HODs) coordinate the activities of respective divisions. The Additional Director has been delegated the task of coordinating and monitoring the scientific and technical divisions. She is to chair the Scientific Operations Committee (SOCM). The periodic administrative restructuring as mentioned above reflects the existence of an internal mechanism for monitoring and evaluation and the ability to respond to current needs. Despite the general cordiality among the staff of all grades and between staff of different divisions the national importance of the work that the NSF is involved in has not percolated to some support staff as evidenced by our discussions with the trade unions. This suggests the existence of a communication gap. Discussions with all staff at least intermittently are necessary to maintain optimal awareness and to provide a platform to express their views. We note positively that such an initiative has been launched recently and need further strengthen this two-way dialogue.

IT unit provides commendable Internet and E-mail services to all divisions. There is an effective internal communication and coordination mechanism and each staff member can be accessed through the intercom and from outside through the reception. This facilitates inter-divisional work. Each Division is assigned with clear-cut specific mandate/functions, so evaluation of success or failure is easy and direct.

However, there is no formal mechanism to obtain feedback within the institution. This is especially felt as a need by lower grades of support staff. The lack of coordination between scientific staff and support staff, which happens occasionally, can be minimized by an internal quality assurance system that facilitates shared work towards a common goal.

3.8 Partnerships in Managing Information Dissemination

The institution has made significant efforts using its sophisticated IT capabilities widely to disseminate information to the relevant stakeholders including universities, research institutions, industries, schools and the general public. It also provides reliable and accurate data on scientific activities to policymakers in state and corporate sectors and international organizations. NSLRC's efforts in being the gateway to both local and global scientific information are truly innovative and commendable. It has partnered with many universities and research institutions in this endeavour. This has been the strong point of the NSF over the years. However, the thrust of these activities is largely confined mostly to the scientific community and school children. The impact on the corporate sector, industry and general public has been relatively small. A greater impact in these underserved areas is needed.

The institution has partnered with many organizations in this effort but strangely it has no formal partnership with the SLAAS in this particular activity. The SLAAS has a long and successful track record in the field of popularization of science. A formal linkage with the SLAAS is likely to be mutually beneficial. The proposed National Science Centre is a commendable endeavour in which such linkages may prove useful yet to be materialized.

Similarly, linkages with the corporate sector may facilitate the dissemination of information of technology transfer and commercialization of research products. Although institutional procedures for technology transfer are recommended, the actual achievement in this respect is modest but further improvement is warranted. At present, feedback from stakeholders is taken on an ad hoc basis and that too from stakeholders who are closely involved in NSF activities. Regular and systematic feedback from a wide random sample of stakeholders is likely to be beneficial in program planning. This feedback system will be further useful if it could be developed as a mobile app or mobile web-friendly version.

The NSF website is functioning quite satisfactorily and is updated regularly about current programs and projects. However, the STMIS database is inadequately updated. This needs to be rectified as soon as possible as reliable, keep abreast with the latest and accurate data about scientific personnel is a prerequisite for effective S&T policy and program planning. Network administration needs to be further strengthened.

3.9 Monitoring, Evaluation and Reporting Procedures

NSF adopts a fairly satisfactory monitoring and evaluation mechanism for its divisions and its programs and projects. These evaluation reports are submitted to the Board of Management through respective Heads of Departments. The internal audit officer conducts audit on all activities following, an audit plan and reports directly to the Chairman of the BOM. Internal audit also liaises with the external audit process.

In the past divisions have used different formats for reporting, and over time, these have been streamlined into a common format. However, this mechanism still has its weakness. An Online leave approval system together with an ERP system will be suggested to streamline these activities in future. It is not supported by a Management Information System (MIS). IT facilities are inefficiently utilized for this purpose. An MIS is likely to facilitate access to information needed for decision making at all levels. Presently the reporting is taking place at a variable pace in each Division and on an ad-hoc basis to justify additional funding requests from the government. Information about all research projects and other programs conducts and supported by the NSF is not saved in one central location. These all issues will modestly address with an ERP system.

NSF gets the support of many stakeholders to carry out its multifaceted activities. It has gained the goodwill of most in the scientific community. In terms of evaluation of project proposals, progress reports and final reports, there is a reliable system, and in the recent past, these activities were streamlined to make the full use of time and available resources.
The budgets, expenditures and other financial information related to completed as well as ongoing projects are kept at the accounting division but are shared with the implementing division as and when necessary.

4.1 Brief Descriptions of the Main Outputs

The NSF does not research on its own (except in the area of S&T policy) and does not develop technologies. It financially supports and coordinates research and technology development in other institutions. (Maybe it is time to revisit this policy. If there are capable people in the NSF they should be given the opportunity and the financial support)

1. Technologies developed

Following are considered as significant achievements on the research carried out under Research and Development schemes.

- A non-invasive device to detect endothelial dysfunction to use as a screening method of early diagnoses such as diabetes, CKDu and Cancer.
- Compost block using invasive aquatic plants.
- Electronic Devices for Energy Saving, Design & Prototype Fabrication.
- Student Response system for a classroom audience
- E-Health Kiosk.

2. Innovative Technologies transferred to local industry / and other entrepreneurs

Following are considered as significant achievements on the research carried out under the Technology Grant schemes.

- A beverage rich in whey protein, a byproduct of the Cheese industry.
- A low-cost low powered workstation for management of the Leprosy patients.
- Commercial level pulse Oximeter
- ECG measurement module
- MODA- Microbial Oxidative Degradation Analyzer.
- Quality improvement of prototype diesel fuel pump test bench.

3. Information Dissemination / Extension

Information dissemination has been done mainly through workshops and seminars (127 during the evaluation period) and competitions (13 during the period). We have noted further, that NSF has taken several important initiatives to establish bilateral collaborations between German Research Foundation (GRF), German Academic Exchange Service (DAAD), Japan Science and Technology Agency (JST) and Pakistan Science Foundation (PSF). The NSLRC have been modernized and updated during the last four years. Following are some of the successful events conducted by NSF.

NSF Grant Scheme for Promoting Science and Technology Publications

Relevant to the requirement of the country, NSF has initiated this grant scheme to financially support authors to publish books and other reading materials related to Science & Technology and thereby increase the availability of printed/online materials in Science and Technology. The authors may apply this scheme by sending the necessary documents.

Submitted manuscripts will be peer-reviewed by two subject specialists/experts identified by the NSF based on their respective fields to ensure scientific validity, the authenticity of the content, and its suitability for the target audience. Granting will be considered based on the importance of the publication to the local needs, qualifications/experience of the author in the related field and accuracy of the content. This is highly commendable.

World Science Day

As declared by the UN in 2001, November 10th of every year is celebrated as world science day for peace and development. This year the theme of World science day, the "Open Science, leaving no one behind" aims at increasing the awareness of the "Open Science" concept among the general public. According to the UNESCO website, open Science has been a burning issue in the scientific community, which is gaining increasing attention by the non-scientific community as well. Innovators, engineers, tech developers, both from the private and public sectors are embracing the open science and open innovation concepts. And policymakers and citizens are increasingly embracing the concept of open science as a tool for making science more accessible, the scientific process more inclusive and the outputs of science more readily available. Thus, Open Science can be a game-changer for achieving Sustainable Development Goals, particularly in Africa, least developed countries, landlocked developing countries, and Small Island Developing States. National Science Foundation of Sri Lanka had organized a special World Science Day Event on the 1st of November 2019 at the BMICH auditorium to celebrate this year's World Science Day for Peace and Development. This year the celebration was held with the theme "Sustainable use of earth resources". Mr. Chinthaka Lokuhetti, secretary of the Ministry of science technology and innovation participated in the event as the chief guest while Dr P.B. Dharmasena, a leading soil scientist from the Ministry of Mahaweli Development and Environment delivered the keynote speech. In his speech, he discussed the current status of the Earth Resources and how scientific knowledge can be used in the sustainable management of those resources. The winners of various school-level competitions including Short Science Drama, Role Play, Science Essay, Viridu, Songs, Bridge Designing Contest and Digital Story Telling Competitions and Science Research Project Competition 2018 and Sri Lanka Science and Engineering Fair 2019 were felicitated at this event. This year the NSF award for the best science teacher who contributed towards the popularization of science was awarded to Mrs B.K.U.B Abeysekara from Ananda Vidyalaya Colombo. NSF Media Award for media personnel who contributed to the popularization of science was awarded to Dr R.S. S. Samarakoon from the University of Colombo and Dr Manoj Prasanna from Upali Newspapers. This year the main award of the world science day celebrations; Prof. M.T.M Jiffrey Lifetime Award for promoting science among the general public was awarded to Prof. Rangika Halwathura from the University of Moratuwa for his immense contributions in popularizing science within the Sri Lankan society. School children representing School Science societies, their teachers, Scientists, and other guests participated in this celebration.

Digital Library

The Digital Library of the NSF has expanded with the addition of over 20000 full- text documents. The digital library provides facilities to browse search and download all NSF publications online.

Database Development

As the National Focal Point for the dissemination of Science & Technology (S & T) Information in the country, the National Science Library and Resource Center (NSLRC) of the NSF provides an efficient information dissemination service to the scientific community using information communication technologies through the strengthening of linkages and networks, by carrying out necessary programmes to foster the interchange of scientific information among scientists in Sri Lanka and foreign countries, by serving as the National repository of Science & Technology Literature and by facilitating an efficient Science and Technology information services through training of library professionals and provision of technical assistance. Sri Lanka Science Index Database has been established and during 2012 has been updated with the addition of 9073 records showing a very high growth rate. Newspaper articles database, Sri Lanka Association for the Advancement of Science and the Research Grants databases were updated. Project 01 of the National Digitization National Digitization Project, a five-year National Digitization Project has been launched to strengthen the current National Network of Institutional e-Repositories. The first Phase was completed covering 15 institutions in the country and data uploading to the institutional repositories is going on. The objective is to offer a mechanism to access the total scholarly literature output in the country online for easy access by scholars to support and promote productive research. Phase I of the project covering six institutions in the country was initiated and is in progress.

Services to Other Libraries on Computer Catalogues/Databases

Consulting services were provided to libraries in the county on 73 occasions in developing new databases, improving the existing databases and providing support and standardizing them. Ten new catalogues of other libraries including the National Museum library were hosted in the NSF server to increasing the visibility of the resources in the respective libraries.

Sri Lanka Science & Engineering Fair (SLSEF) and Science Research Projects Competition (SRPC)

Under the above program, training/review workshops and competitions were conducted and more than 50 students' projects were carried out. Ten projects were completed and one was selected to participate at this Sri Lanka Science and Engineering Fair conducted in collaboration with Intel, the Ministry of Education, and the Institute of Engineers Sri Lanka (IESL).

Collaboration in Research and Higher Education Activities between Sri Lanka and Sweden

A team of Sri Lankan Vice-Chancellors with NSF representatives visited Sweden to have a direct dialogue with Swedish counterparts to work out a sustainable and effective mechanism for collaboration in research and higher education. The Swedish Foundation, with prior consultation with the NSF, arranged a three-day program. Accordingly, the Team visited several universities, research institutes and funding agencies in Sweden to realize the intended objectives through bilateral cooperation between the two countries. In association with the Swedish Foundation for International Cooperation in Research & Higher Education (STINT), the Sri Lankan Team had a series of discussions on bilateral cooperation with the primary focus on; **1**. Establishing new collaborations between universities, research institutes in two countries. **2**. Strengthening and consolidating existing collaborations to harness the maximum benefit in potential areas. **3**. Exploring possible funding mechanisms to uplift the collaborative research system between Sri Lanka and Sweden. **4**. Observing and sharing the experiences in setting up and maintenance of laboratories. **5**. Understanding the Swedish system for innovations. **6.** Evaluation of impacts of collaborative research between two countries for completed as well as ongoing projects. **7**. Exploring the possibilities in making use of Swedish research facilities The STINT with prior consultation with the NSF had programmed visits to identified institutes facilitating the Sri Lankan Team to accomplish its mission effectively. Thus, the Team was able to have in-depth discussions during the visits to Uppsala University,

Chalmers University of Technology, University of Gothenburg, Stockholm University, Karolinska Institute, The Sahlgrenska Academy, and Swedish Foundation for International Cooperation in Research and Higher Education (STINT), Swedish Research Council and Swedish Innovation Agency (Vinnova). The NSF was finally able to fruitfully identify possible areas for collaboration, potentially available resource persons for newly proposed faculties of several Sri Lankan universities especially for Sri Lanka Institute of Biotechnology (SLIBTEC), possible funding opportunities to strengthen collaborative research work and experts willing to work with NSF thematic programmes.

In addition to the above the following new activities were also initiated:

The joint call for the proposals by NSF and National Natural Science Foundation, China (NSFC) on Health Sciences, Water and Environmental Sciences was opened up.

The first joint call for proposals on Project Based Personnel Exchange Programmes (PPPs) between NSF and previously mentioned DAAD was opened.

The first joint research projects between NSF and PSF on Health and Material Sciences was initiated.

4. Publications -

Research Publications

1. *Journal of the National Science Foundation* (JNSF) is the only journal to be included in the SCI, in the country. Four issues of the JNSF have been published per year. JNSF achieved the Clarivate Analytics Journal Citation Index Status, 0.305 (2017), 0.419 (2018), 0.378 (2019).

2. *Sri Lanka Journal of Social Sciences* (SLJSS) entertains suitable social science articles focused on Sri Lanka and/or other South Asian countries. Two issues of the SLJSS per year were published. It was also reported that SLJSS one of the few Sri Lankan Journals indexed in Emerging Source Citation Index (ESCI).

Other Publications

1. The publication "*Akramanasheeleeshak*a" for the general public was published and the printing of the publication "Introduction to Nuclear Technology" was sponsored by the NSF.

2. *Vidurava Science Magazine*-Three issues of the Vidurava Science Magazine in all three languages were published every year and were distributed to the schools of the registered School Science Societies, Universities and Vidatha Resource Centers.

3. "Natural Resources of Sri Lanka: Conditions, Trends and Prospects" is a new publication launched by NSF.

Only a limited number of children stories and science books have been published during the last three years. The number of science books available in local languages is limited and the review panel proposes to make additional funds available for science popularization through the publications (in all three languages) targeting school children.

5. Patents

During the period of evaluation NSF has assisted in establishing 38 local patents and has financially assisted in such endeavours.

6. Services (Consultations, Advisory etc.)

The WHO program for a multidisciplinary, multi-sectorial research program to investigate and evaluate Chronic Kidney Disease in the North Central Region in Sri Lanka (CKDu) was supported by Ministry of Finance funds administrated through the NSF. NSF monitored the project based on its normal progress review mechanisms up to completion. The WHO has shared a paper prepared for publication. In addition, NSF has supported many conferences and symposia in various institutions during the period of under review including one international conference.

Competitive Research Grants

The competitive research grant scheme was continued to assist and to supplement the financial, physical and manpower resources available for scientific research by supporting basic and applied scientific research in the scientists' own institution. A total of 36 grants were awarded in 2017, while grants were completed. For the 2019 call for applications, 94 applications were received; 82 were processed, and 20 were approved but fund disbursement remained critical.

Postgraduate/ Postdoctoral Awards

Three new scholarships were awarded up to August 2019. Eight applications were received for 208-19. During 2018, two Fellowships were awarded, while three were ongoing. The Postdoctoral Research Scientists award provides an opportunity for scientists/ engineers with good research records and post-doctoral degrees to carry out full-time research within the country.

NSF has a twenty-nine research staff of which six are PhDs, three are M. Phil and eleven are M.Sc. The areas of expertise are Science (19), Engineering (1), Agriculture (7) and Veterinary Science (2). With these assets, the Institute should look into the possibility of generating funds internally and provide better remuneration to the staff.

Technology Grant Schemes

Technology Grant Schemes were implemented during the assessed period for Support for Technology Development and Support to initiate businesses based on novel technologies.

During 2017-19 there were nine Technology Grant Applications were approved out of 26 received for funding. Eight were approved for funding by the BoM for funding as seven for Tech Development and one for Start-Ups. During this period further 26 approved grants were completed.

National Network of Institutional e-Repositories

The foundation was laid in 2010 for a National Network of Institutional e-Repositories among universities and research institutions in the country. The current network covers 15 libraries. To develop a regional network, a workshop has been conducted to train librarians of nine countries in the Asian region on D Space Digital Library software. NSF team assigned this activity helped in further popularization of e-Repositories among the Universities and Research Institutes actively and it is exemplary.

Popularization of Science

Services for Schools & School Children: School Science Society Programme

Over 1030 School Science Societies have registered with the NSF (totaling up to registered schools). NSF has provided the service of the resource persons to deliver lectures on a range of scientific topics for schools during this review period 41 (2017), 98 (2018), 1030 (2019) for school science programmes and workshops. Further workshops were conducted for science teachers to empower them on strengthening the activities of the School Science Societies in order to popularize science among the school children. Science popularization programmes among schools had shown tremendous progress during the period of 2017-19 is highly commendable.

7. Training

NSF staff has participated in 72 local and 25 foreign training programmes in 2017, 41 local and 19 foreign training programmes in 2018, 53 local and 17 foreign training programmes in 2019 during the period under the review. Approximately 264, 341 and 346 training occasions and opportunities were distributed among various staff categories in years 2017, 2018 and 2019 respectively.

8. Others(Miscellaneous)

National Thematic Research Program (NTRP) :

This scheme is useful to direct Research and Development to address the need of society. NTRP was introduced to identify multidisciplinary, multi-sectoral mission-oriented research activities based on national needs through a structured process with end-products that can be harnessed readily in tackling on the ground issues and to contribute more effectively to the national development. Five themes have been selected awarded during the period under review while seven of such initiatives have been completed under various thematic areas. Four grants in 2017 and one grant in 2019 have been awarded under the theme Food Security by 2019. Completed grants were included here that were awarded prior to 2017.

Research Equipment & Spare Parts Grants

Travel Grants & Scheme

Under the Travel Grant & Scheme in the 2017/2019 period, more than 200 applications were received and processed of which 148 successful applicants were awarded.

Overseas Special Training Program (OSTP)

Under the OSTP, 100 applications were received and processed of which 81 successful applicants were awarded during the period of 2017/19.

International Partnerships for Science & Technology (IPSAT)

There were 23 research scientists and post-doctoral training was trained in various locations around the globe USA, UK and many other destinations.

Japan Science and Technology Agency (JST) The first joint workshop

Japan Science and Technology Agency (JST) The first joint workshop, "Strategy for Conservation and Utilization of Animal Genetic Resources in Asia" between the NSF and JST was held on 10th October 2018 in Tokyo with the participation of Thirty-Seven (37) participants representing three (03) countries; Japan, Sri Lanka and Thailand. A team consisting of sixteen participants; Prof. Ananda Jayawardane/Director General Mr Wasantha Anuruddha/ Principal Scientific Officer and Ms Thilinakumari Kandanamulla/ Scientific Officer from NSF, three senior and ten young scientists from Sri Lanka attended this event. The event enabled a discussion platform leading to the formation of the next theme of the 08th call of the e-Asia Joint Research Programme (e-Asia JRP) on Agriculture to be launched in 2019. NSF will be partnering in this joint programme.

STMIS-S & T Management Information System

STMIS database, (https://stmis.nsf.gov.lk/) active from September (2019) is a computerized information system on Science and Technology which is online and provides S&T information and indicators for policy planning and implementation. It undertakes registration of S&T personnel in the country. Around 6493 scientists up to 31-12-2019 have been registered and identity cards are being issued to them. This database is continuously being updated to cover the whole S&T sector.

Postgraduate/ Postdoctoral Awards

The number of awards in the section of the Postgraduate and Postdoctoral awards was significantly higher. There were more than 31 such grants were awarded during the 2017/2019 period and 10 were completed during the same period.

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4.2 Quantitative Summary of Outputs (2017 –2019)

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.

Category	2017	2018	2019
1. Technologies transferred to industry / entrepreneurs • Technologies developed locally • Foreign technologies adapted and transferred	02 - -	02 - 03	01 03
2. Information Dissemination / Extension **Publications** • S & T institutional Review Reports • Training Manuals	 - -	 - -	 01 -
• Advisory Leaflets • Maps • Posters **Dissemination events** • Workshops and Seminars • Conferences • Exhibitions • Media Events • Open Days • Demonstrations • Competitions	06 - 01 29 03 03 - - - 04	- - - 42 01 01 02 - - 04	03 - 0 45 02 01 02 - - 03

3. Publications • Research papers in ISI journals • Other Research Papers • Referred Abstracts • Conference Proceedings • Books and Monographs • Technical Reports • Research Reports • Book Chapters • Science Magazines (in all 03 languages) • Science Books • Children Stories • Journal • Policy Brief • News Letters • Other Publications	- 02 01 - 01 - - - 09 01 - 06 03 06 -	- - 01 - 01 02 - - 09 01 - 06 03 03 01	01 01 10 01 03 05 - 02 09 03 - 06 06 05 -
4. Patents ***Individual*** • Local *Patents (NSF doesn't own patents, consultation was provided on patentability/ filling applications etc)* • Foreign Patents *(Financial supported)*	6 12 0	 13 -	 13 -
Institutional • Local Patents • Foreign Patents	- -	- -	- -
5. Services (Testing, Calibrations, Consultations, Advisory and etc.) • Policies developed	01	-	-

• Reviews of S&T institutions • Research grants awarded and administered • Funding for training programs and other S&T activities • Monitoring of Technology/ Research Projects (ongoing) • Data bases developed • Databases of Scholarly literature of local origin - 03 databases (ongoing/ Sri Lanka Science Index, SLAAS database, Newspaper Articles database)- ***No. of new records added*** • NSF Digital Library of full text literature • National Network of Institutional repositories (Institutions joined) • S&T surveys and maps • Science popularization activities • Environmental impact assessments	- 76 19 OSTP Grants +37 Travel Grants	- 38 17 OSTP Grants +36 Travel Grants	-
Instrument calibrations • Consultancy services • Testing and analytical services • Vaccines / seed production and distribution • Germplasm conservation • Recommendations in S&T matters	- - - - 	- - - - 17 from 2 studies	
Training ***Staff training programs*** • Local • Foreign ***Training programs for stakeholders*** Attended as Resource Person	97 72 25 02	60 41 19 02	70 53 17 02
6. Other • Awards (through NSF Research Award Scheme, SUSRED Award Scheme /Awards for Supervision of PhD Degree & S & T Awards) • Implementation of the IDRC funded project "Development of Biotechnology in SL" • Coordination of projects between local and expatriate scientists originated at the Global Forum/ Alliances • TWAS/NSF Young Scientist Awards was won by a local scientist.	 03 01 10 01	 04 01 15 01	 00 - 16 01

4.3 Staff Strength

The Permanent Staff in the Institution

Staff Category	2017	2018	2019
S & T Personal	28/38	36/38	34/38
Administrative Staff	16/25	23/25	20/25
Technical Staff	13/15	11/15	10/15
Supportive Staff	59/66	61/66	60/66
Existing/Total Cadre	116/144	131/144	124/144

Research Staff Based on Areas of Expertise

Areas of Expertise	2017	2018	2019
Science	14	19	18
Engineering	1	1	1
Medical & Health Science	-	-	-
Agriculture	6	7	7
Veterinary Science	2	2	2
Other	-	-	-

*Note: Include Director and Additional Director

Highest Level of Qualification of Research Staff

Qualification	2017	2018	2019
PhD.	4	6	5
M.Phil	4	2	2
M.Sc. or Equivalent	10	14	12
Basic Degree.	10	14	15

*Note: Include Director and Additional Director

5.0 Productivity of the Institution Based on Outputs and Science and Technology Staff Strengths

These comments are based on NSF's outputs and staff strength during the period 2017 – 2019 as provided by the Director NSF in the self-assessment report and subsequent updates. Our comments are given following the guidelines provided in the review manual prepared by NASTEC. There are eight output categories defined in the manual.

They are;

a. Technologies developed
b. Technologies transferred to industry/ entrepreneurs
c. Information dissemination/ extension
d. Publications
e. Patents
f. Services
g. Training
h. Other

From 2017 – 2019 the NSF operated with approximately 75% of the allocated cadre of Science and technology personnel. In 2020, the situation improved to 78%. Its performance/outputs were also affected by either non-disbursement or delayed or irregular disbursement of the allocated funds.

Within this context, the productivity of the NSF during this period is truly commendable. Its outputs cover a wide spectrum that cuts across all eight categories defined in the review manual. Although the outputs have been quantified for assessment, in assessing productivity the quality of output is as or even more important than numbers. A detailed description of the outputs is given above to enable one to appreciate their qualitative aspects.

Considering both numbers and quality the review panel graded the outputs in the eight categories defined in the review manual, using a five-point Likert scale (Unsatisfactory – Satisfactory – Good – Very good – Excellent).

The panel's conclusion regarding each aspect is as follows:

- Technologies developed : Good
- Technologies transferred to industry/ entrepreneurs : Good
- Information dissemination/extension : Excellent
- Publications : Best
- Patents : Satisfactory
- Services : Excellent
- Training : Best
- Other (miscellaneous) : Best

Although the number of technologies developed is not large in qualitative terms majority seem to be of great utility value and some are of significant national relevance.

Technology transfer is clearly in upward growth at the NSF. We note that few technologies have been transferred to industry in 2017-19. This aspect needs to be improved steadily in the future through greater industry linkages and more production public Private partnership programmes.

Information dissemination and extension is clearly the forte of the NSF. The wide variety of methods involved, their wide coverage, the numbers and the high quality of the product (e.g. Vidurawa and SLJOL) makes us conclude that the productivity in this aspect to be truly excellent. Sri Lanka Journal Online (SLJOL) is a very rare platform which centrally located giving invaluable support for science dissemination under NSF. This is indeed exemplary.

Publications considered are of two types. Research or research-based publications and educational publications. The output in educational and science popularization publications is excellent in both numbers and quality. However, there is room for improvement in research publications, based on NSF support available. There is a paucity of publications in indexed and peer-reviewed journals. The majority are refereed abstracts. We note that there are a few technical reports and policy briefs of merit and national relevance. The regular publication of the Journal of the National Science Foundation (JNSF), which is the only Sri Lankan Journal to be included in the Science Citation Index (extended) (SCI), is to be highly commended This is referred to in the overview of performance with national development.

The output in patents consultations can be termed satisfactory at best as they are not based on NSF supported research or technologies. The numbers are of individual inventors/ scientists where NSF has supported and facilitated the process of obtaining a patent. In terms of their mandate, it could be reasonably expected for the NSF to obtain patents on products developed with its support. We were informed that NSF has a clear IP policy where NSF has 'March in rights'. The panel feels that NSF could justifiably claim some credit for patents filed by other organizations under their funding. The output in services is excellent with a wide variety of activities of high quality. They are described in the report above. This is to be especially appreciated despite limited scientific staff numbers.

Training has been graded as best based on numbers, variety and quality. They have been viewed positively by both staff and stakeholders. Even though we haven't noted any such obvious discrepancy, it is always better to allocate training opportunities equally among all the staff categories, based on meritocracy.

To conclude the panel views the productivity of the NSF during the period (2017 – 2019) given the huge constraints within which it worked, to be highly commendable. There are a few areas that need improvement. Namely technology development and transfer; area of research publications and obtaining patents on NSF supported work and a few others.

6.0 Overview of the Performance of the NSF

NSF plays a significant role in addressing research and development goals as well as the role for acting as a source of funding, a source of important scientific and technological information and as a mediator/facilitator to promote activities related to Science & Technology in the country's higher education and research institutions, and science popularization in the country in general. To achieve success in these areas, NSF which is governed by a Board of Management headed by the Chairman has set up several divisions that are overseen by the Director-General who is the Chief Executive Officer (CEO) of NSF, with the assistance of the Additional Director. Divisional activities take place based on the recommendations and suggestions made by respective advisory boards, working committees and expert panels. Each Division, headed by (other than the Administrative Division) a scientific officer, comprises several scientific officers and management assistants and/or technical assistants. To assess the overall performance of the NSF, it is necessary to look at the performance of the individual divisions. What follows is a brief critical review of the divisions and their role.

Science & Technology Policy Research Division (STPRD)

NSF has set up the STPRD with the objective of undertaking science, technology and innovation (STI) policy research in the areas specified by the mandate and to make recommendations towards policy formulation and develop various databases and statistical handbooks relevant to all sectors of STI useful for decision making. The National Research & Development survey conducted biennially since 2004 is a key activity. The contribution made by the division to publish the Journal of National Science Foundation, a journal indexed in the SCI is commendable. It is the only division in the NSF that performs research studies, pertinent to S&T policy. The results of these studies should be in the public domain and should be accessible to all policymakers. This is no bar however to the publication of these studies in a peer-reviewed journal with approval of the NSF. The authorship has to be decided using the globally accepted criteria.
Research Scholarship program and SUSRED are new initiatives launched by NSF to improve the quality of the research output in the country.

STPRD also maintains information on Science & Technology through Science and Technology Management Information System (STMIS) database, an important tool that enables NSF to achieve some of its goals. Currently, however, the quality and reliability of the information in this database is fairly satisfactory. This situation needs to be rectified urgently. The review panel also noted the absence of a statistician in the STPRD which deals mainly with the analysis of scientific information.

Research Division (RD)

RD is well established and its major function is to award research grants under different types of grants schemes to the scientific community in Sri Lanka. RD thus receives the majority of funding allocated to the NSF. In addition to supporting the basic and applied sciences through a competitive grant scheme, RD has designed several other schemes to promote the scientific

research culture in the country. These include the Postdoctoral Research Fellowship Scheme, the National Thematic Research Program (NTRP), the Research Equipment Grant Scheme, the Spare Parts Grant Scheme, NSF Research Awards, Quality Assurance of Research and newly introduced policies on National Biotechnology and National Research Development & Innovation. In general, the activities of the RD were highly appreciated by the stakeholders at their meeting with the review panel. Recent steps that the RD has taken to minimize the delays in handling research grants by introducing centralized research proposal evaluation and research progress monitoring schemes are also commendable. The absence of scientific personnel in the division with qualifications from the area of social sciences and insufficient interest among social scientists for the NSF fellowship scheme and publication in the SLJSS were indicative that the social science initiative of the institution is not having the desired impact as yet. However, it is a commendable dispute of the above concerns, we also noted the following initiatives taken to improve the social science section. An exceedingly large number of registrants responding was an indication that this was kind of a timely needed initiative.

We were able to notice that the International Conference organized by NSF on 'Social and cultural nexus of S&T Development' in 2019 was to identify various social and cultural factors that can make a positive impact on S&T.

Further, a Policy Dialogue was in the same vein titled 'Role of Education and S&T Development' and several policy issues were discussed and debated, and all these efforts show that NSF is bent on improving their lacunae in the field of social science.

Organization of a two-day workshop on qualitative and quantitative data collection and analysis to strengthen the upcoming Social Scientists by identifying their training requirements.

In the past, there have been RD coordinated visits to the institution of the research grantee as a part of progress monitoring. It was learned that this monitoring mechanism is still practiced on an irregular basis due to a lack of logistic support.

Technology Division (TD)

The Technology Division of the NSF has been established in 2005, with a view to promoting technology development and innovation in the country. Activities of the TD have been designed to foster innovation in all areas of S & T, including biotechnology and nanotechnology. TD provides financial support for technology development projects with the support base extending to even grass-root level inventors. In addition to awarding technology grants, the TD provides awards for excellence in technology, assists stakeholders in intellectual property awareness & protection to encourage technology development & innovations to generate new or improved products. TD is mainly involved with the National nanotechnology initiative. *Its main programmes and projects are designed to foster innovations in all areas, especially biotechnology and nanotechnology, creating wealth and economic growth of the country. TD takes R&D outputs which have commercial potential and support further development in the value chain to a marketable level.* TD has made good progress considering that is relatively young, compared to the RD.

SPD provides financial support to the Institute of Physics, Sri Lanka (IPSL) and the Institute of Biology, Sri Lanka (IBSL), to conduct highly popular Olympiads in Physics & Astronomy and Biology respectively. The review panel is of the view that the science popularization programs conducted by SPD can be improved to reach a broader audience through formal linkages with professional organizations such as the Sri Lanka Association for the Advancement of Science (SLAAS), Sri Lanka Medical Association (SLMA), and Institute of Engineers, Sri Lanka (IESL).

Given the number of activities and the extent to which the SPD can reach the masses through its programs, it needs to take adequate steps to conduct an impact assessment of NSF publications, both popular science books and textbooks, to survey their market potential and to obtain recognition through bodies such as National Institute of Education (NIE) for their use in schools as supplementary readers. Such measures will enhance the capacity of SPD for generating funds through its publications. Attention given by the SPD to the Social Sciences is inadequate.

National Science Library and Resources Centre (NSLRC)

National Science Library and Resources Centre (NSLRC) of the NSF acts as a source of dissemination of S &T information in the country by maintaining a database on NSF publications, Sri Lankan scientific publications and resources available in Sri Lankan libraries. The objective is to serve as the national repository of S&T literature. The efficiency of the information service has been enhanced through a network (Sri Lanka Science & Technology Information Network) operated among S&T libraries in the country. Currently, the division is working towards the digitization of NSF publications. This division assists in enhancing IT applications in SLSTINET member libraries and library networks. It also conducts services to the library community in the country through training programs and seminars.

The review panel found that not all publications and other sources of information from the NSLRC were equitably available in the second national language, i.e. Tamil. This imbalance needs to be rectified. It was also observed that the information network needs to be extended to areas such as Social Sciences and Archaeology.

International Liaison Division (ILD)

ILD works to foster the interchange of scientific information among scientists in Sri Lanka and foreign countries promoting and assisting Sri Lankan scientists and technologists to participate in meetings, short term research work abroad and arranging for expatriate scientists and echnologists to work in Sri Lanka in the short term assignments by providing financial assistance. It has played an active role in events such as the Global Scientific Forum which was held in 2011 in Sri Lanka, providing an opportunity for the Sri Lankan scientists to learn about the work carried out by Sri Lankan expatriate scientists. It was found that ethical issues of some research collaborations initiated between Sri Lankan scientists and expatriate scientists needed review before implementation. Several bi-lateral partnerships with MOUs have been implemented during the period under review. Partnership with NSF of China, Pakistan Science Foundation, Japan Sciences and Technology Agency, German Academic Exchange services (DAAD), Russia and Brazil are few of them.

The Journal Publication Division

The Journal Publication Division (JPD) mainly focuses on disseminating findings of research carried out by local and foreign researchers in the disciplines of sciences and social sciences, through the publication of two academic journals and financially supporting publications, conferences and scientific meetings. The main functions of the JPD are identified as Publishing Journal of the National Science Foundation of Sri Lanka (JNSF), Publishing Sri Lanka Journal of Social Sciences (SLJSS), Supporting Publications Fees in Indexed Journals of Sri Lankan Scientists, and Support Scheme for Scientific Meetings and Events (SSSME).

Administrative, Finance and Internal Audit and IT Divisions

A major task of the Administrative, Finance and Audit divisions is to assist the NSF in human resources, financial asset and logistics management following the regulations and guidelines accepted by the government institutions. These divisions, therefore play a supporting role to the RD, TD, SPD, NSLRC and the ILD that conduct scientific activities. The success achieved by these divisions is a reflection of the quality of the support services. Though these divisions seem to practice standard operating procedures fairly and transparently. The panel noted the absence of a manual of procedures approved by the DMS. This could potentially hinder administrative decision making and promote slavish adherence to outdated "R&R".

The Information technology (IT) unit has the technical and human resource capacity to adequately support all IT needs of the NSF. In fact, its capacities are not utilized to their full potential. At present, it is being further strengthened with support from UCSC under ICTA supervision. This should facilitate even better and more rapid access to information in the future.

In conclusion, the NSF is functioning well, within its wide ambit and is on track to achieve five out of the six goals it has set for itself in the Corporate Plan 2013-2017. However, goal two, which addresses the issue of technology development and transfer it is lagging. The Technology Division is performing well within its limited capacity. The limiting factor is the rather conventional mindset of the NSF in this regard. Lateral thinking and innovative approaches such as promoting academia-industry incubators may be needed to bridge the gap.

7.0 NSF's Contribution to National Development

The review panel is quite familiar with the tremendous contribution the NSF and its predecessors have made to national development over the last four and a half decades. During the last four years (2009 – 2012) NSF`s contribution has been especially significant. In post-conflict Sri Lanka, government policy has emphasized the need to move towards a knowledge-driven society and economy. There has been a special thrust towards science and technology and the need for knowledge creation, innovation, and technology transfer as means of improving the quality of life and standards of living. This socio-political and economic context seems to have galvanized the NSF into action and it has come up with several new initiatives. During most of this period, the NSF has been fortunate to have a mature scientist at the helm of policymaking as the Minister in charge.

There is a very wide spectrum of NSF activities that have an immediate or distant impact on national development, but in a critical review where brevity is of the essence, only a selected few can be highlighted. In the view of the panel, the following are those with the biggest impact.

1. National Nanotechnology Initiative which led to the creation of SLINTEC. The panel especially appreciates the fact that this was coupled with the drawing up of a national regulatory framework for nanotechnology and a national awareness campaign on nanotechnology. This is a comprehensive intervention that will serve as a benchmark for such activities and has succeeded in taking Sri Lanka to the cutting edge of science. The panel however notes with regret that the economic benefits of this ground breaking initiative have not accrued to the NSF as SLINTEC has become totally independent of the NSF.

2. The regular publication of the Journal of the National Science Foundation (JNSF) and its inclusion in the Science Citation Index (SCI) is a significant achievement as it provides local scientists with a platform to reach out to the rest of the global scientific community. The panel notes with concern that very few of the NSF grantees have made use of this platform.

3. NSLRC`s contribution in making both local and global scientific information readily accessible to all Sri Lankans is highly appreciated. The panel feels that it should be further supported with resources to complete the task they have embarked on.

4. There is one activity that the NSF has done in the past and continues to do at present which is unsung and little appreciated except by the recipients viz. Supporting basic research through research grants often facilitates the researcher getting a post-graduate degree. This is tremendously important in scientific capacity building and in generating some basic knowledge that could lead to nationally relevant applied research. The panel strongly recommends that NSF continues to support basic research.

5. Not all initiatives achieve success. But they deserve credit for trying. The effort by the NSF to bring social scientists into the mainstream of science falls into this category. The progress report of the National Committee on Social Science is impressive but the panel feels that there is a long way to go in achieving this objective. Somehow social scientists do not seem to feel that the NSF is their forum. The failure to sustain regular publication of the Sri Lankan Journal of Social Science (SLJSS) is evidence. The panel congratulates the NSF for its effort and recommends it persists with it. In this respect, it would be desirable for the NSF to recruit at least one social scientist to its scientific staff.

6. There are several other aspects of NSF work like science popularization in schools, provision of S&T data for policymaking, development of national policy on biotechnology, national thematic research program which has great potential to contribute to national development.

7. Some initiatives that are yet in the proposal form or in an embryonic stage of development have tremendous potential if carried forward correctly. These include the establishment of a national science park/center, technology development, and transfer through science/technology incubators with academia-industry collaboration. These will not only contribute to national development but will enable the NSF to generate its own income.

8.0 Recommendations

NSF has made considerable progress in the period from 2017-2019. In general, NSF has developed into an organization that provides valuable services to its stakeholders. This was well reflected during the meeting that the review panel had with several stakeholders including senior university academics, representatives from research institutes, private organizations, schools and the general public. To further strengthen and expand the scope of its activities to the benefit of both the stakeholders and the employees of the NSF, the review panel wishes to make the following recommendations, taking into consideration the progress that the NSF has made during the period from 2017-2019.

Administrative and Financial

1. The review panel recommends that there needs to implement fully the approved process manual and standing operation procedures to enhance the activities of the NSF and make sure more transparency of the activities and quality of all deliverables.

2. NSF should continue to support both basic and applied research, maintaining the existing balance of; 40% - basic research**:** 60% - applied research ratio, while encouraging technology-oriented multidisciplinary research. Field visits to the research grantees' institute/organization as a part of research progress monitoring are considered a good practice and should be continued regularly.

3. Measures should be taken by the NSF to strengthen the programs/activities and human resources in the area other than Medicine and Science but also social sciences and humanities as well as Agriculture to raise it to the level of other S & T projects supported by the NSF.

4. Ethical Review Committees and Institutional Animal Care and Use Committees (IACUC) should be promoted by NSF and should take the lead on matters related to professional ethics and ethical aspects in animal research, especially in the life sciences by reviving its ethical review committee recommendations.

5. Financial support for the period of evaluation has been received mainly from the treasury. There are huge delays in financial disbursement during the crisis as well as in general should be corrected. Fund allocation has shown a significant improvement over the period of three years with the majority of the funds being allocated to the RD. There is a significant difference between the funds that have been spent by the NSF and the funds that have been allocated. This difference is attributed to the untimely and insufficient release of funds by the treasury. Both increased funding and its timely release are important for the smooth functioning and improved services of the NSF. However, the root cause of the delay needs to be identified correctly so that process is expedited and simplified.

6. The management of the NSF should consider the generation of funds using its own resources. For example, the review panel identifies the NSLRC and the Printing Unit as potential fund generating divisions/units provided that proper marketing strategies are used. Since the NSF is a service-oriented organization as per the Act it will be

advantageous if the NASTEC could assist/direct the NSF the way of keeping and re-using the earned funds with the NSF without sending this back to the Government Treasury. A suitable mechanism should be worked without impinging the mandate of the NSF and adopting to the present needs.

Dissemination of Information

7. NSF should have to move technology-driven data management systems such as the ERP and digitalize its activities with the consultation of ICTA.

8. NSF should find ways and means to share the information generated by some of its divisions within and outside the organization and, to be used for policy planning. Properly maintained databases such as STMIS can be utilized very effectively by the NSF for setting up advisory boards, evaluation panels, progress monitoring committees and review panels for NSF publications. Thus it is recommended strongly that this data base be updated with accurate information.

9. NSF policy on publication should be reviewed for prioritizing their publications in terms of importance, demand, the required recognition and also the validity of materials being published. Publication of the Journal of Social Sciences should be streamlined. Consideration should be given to publishing materials in both state languages whenever possible.

10. Mechanisms should also be in place to make the employees of the NSF and its stakeholders to be aware of the achievements and outputs of the NSF and to receive their feedback. Obtaining the views of employees at all levels within the organization may prove useful when formulating future plans.

11. NSF should take the leadership to disseminate scientifically accurate information to the public, as provided by respective expert/s in the field/s, on a day to day problems of national importance (e.g.: Postharvest technology, Chronic Kidney Disease in certain areas of the country, Toxic waste from industries and its effects on the environment, Natural disaster-related accidents, etc.)

Human Resources and Work Environment

12. It is recommended that a mechanism is in place to recognize qualifications (e.g. postgraduate qualifications) and/or exposure gained through relevant training programs for the promotion of employees at all levels within the organization.

13. NSF should take measures to provide relevant training opportunities to employees at all levels based on a training needs assessment and ensure that such training opportunities are effectively utilized through an incentive scheme.

14. The management of the NSF should take adequate measures to improve the facilities such as health benefits (and loan schemes) for its employees. By combining with other scientific institutions it may be possible to provide employees with a subsidized health insurance scheme.

15. NSF is located on a spacious prime land in the City of Colombo where essentially all the NSF employees occupy a single multi-story building in a congested environment. NSF should consider taking measures to minimize the congestion in the building interior by upgrading the building infrastructure to provide better ergonomics (both interior and exterior) to its employees.

16. NSF should introduce a suitable SOR, information storage, and retrieval system. This will ensure data integrity. We further like to recommend SOP, namely, a standard operating procedure is a set of step-by-step instructions compiled by an organization to help workers carry out routine operations. SOPs aim to achieve efficiency, quality output, and uniformity of performance while reducing miscommunication and failure to comply with industry regulations. It is time to have an experienced human resource manager whose position should be permanent.

17. Need to make use of new media such as Facebook, Twitter, YouTube, and popular TV Channels too.

NSF Review Report

I. Management Practices Assessment

1) **Always** used/ always considered/ involved/analysed = **Strong**
2) **Occasionally** used/ considered/ involved/analysed = **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 to plan and respond effectively to challenges and opportunities, and to deliver results that are Levant and useful.

The external environment of the Science & Technology / Research & Development institutions 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 an organizational strategy for the institution		*		Corporate Plans for 2009-2012, 2013-2017, 2018-2021 indicate consonance with government policy.
The organizational mandate (as specified by the relevant Act) is considered in strategic planning	*			Clear connection with corporate goals.
The institution is responsive to changes in Government policies and strategies	*			New initiatives like the Nanotechnology Initiative and the Global Forum of Scientists.

Factors such as strengths, weaknesses, threats and opportunities are considered in strategic planning		*		A Good SWOT analysis was done. NSF should study it properly and take corrective actions to overcome negative aspects and try toimprove the positive aspects further.
Stakeholders needs are taken into consideration in strategic planning			*	They are involved through National committees. A wider consultation is needed.
The Board of Governors is involved in strategic planning		*		They have taken the lead. Must get the views of stakeholders as well as the other staff members.
The extent to which staff members are involved in strategic planning			*	Room for more improvement in this aspect Internal discussions and good feedbacks are essential for improving the planning process.
Government allocations and alternative funding opportunities (donor funding) are considered in strategic planning			*	Alternative funding sources are not given adequate attention. Need to look for additional sources offunding seriously.
The extent to which policies and plans of the organization are reviewed and updated			*	To some extent. There is room for improvement.
Modern technological driven management practices should be introduced.				

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		*		In agreement with working committees, those goals have been set up to address the issues of national importance.
Board of Governors participate in planning and priority setting of a program		*		Final approvals and recommendations were made continuously.
The extent to which the staff of the institution participate in programme planning and priority setting			*	Technical Committees and Advisory Committees evaluate the proposals and recommend to the Board of Management for approval. Staff participatory approaches should be improved.
Stakeholder interests are considered in programme planning		*		There is a moderate selection of stakeholders in all decision making committees.
The extent to which programmes are planned and approved through appropriate procedures		*		Very clear and transparent process implemented through Working Committees and Advisory Boards. A wider consultations are encouraged.

The extent to which the availability of funds (government allocations and other funds) generating funds are taken into consideration in planning programmes		*		The availability of government funds is given the most consideration. Currently, other funding sources are inadequately explored.
The obtaining of necessary equipment is considered in planning programmes		*		Followed national procure- ment guidelines
Stakeholders are represented in the institution's planning and review committees.		*		Very inadequately. More could be done
The extent to which socio economic and commercialization aspects are considered in program planning.			*	Not adequately. Can be strengthened further.
Effectiveness and efficiency of institutional procedures in approving new S&T programs.		*		Achieved through national committees and advisory panels. Process could be further streamlined.

Additional observations (if any)

N.S.F should be the *think tan*k to advise on environmental problems, Air pollution, Drug proliferation, in other words problems and issues that come to the public sphere from time to time to the relevant authorities. Additional observations

We also noted the Winning of Best Annual Report, *. Congratulations.

For the Second Time as well

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, a 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 programs. 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		*		Corporate Plan gives the general guidelines. However, there is no formal training in project planning. They learn it on the job. More could be done.
Previous research results/data are used for planning projects			*	Reviewers ensure this by vetting the literature review of project proposals submitted for review. NSF also take seriously findings of relevant research.
The extent to which the institution follows a formal process for preparation, review and approval of projects	*			Very clear and transparent process. Technical Committees and Advisory Committees evaluate the proposals with help of external review as needed and recommend to the Board of Management for approval.

The extent to which organizational plans (e.g. medium-term plan, corporate plan, strategy etc.) are used to guide project selection and planning		*		The research projects are planned by individual scientists based on their interests. All other projects are planned by NSF committees and staff guided by the rolling strategic plans.
Multidisciplinary projects/ activities are encouraged by the institutions		*		Priority is given for multidisciplinary research by the Working Committees and Advisory Boards. NTRP set up especially with this objective.
Foreign collaborations are encouraged and incorporated in planning.		*		'Global Forum of Sri Lankan Scientists' was especially for this purpose. International Liaison Division coordinates the partnership for S&T (IPSAT). More needed to be done.
Partnership with private sector is encouraged by the institution			*	Not adequately. There is a need to proactively consider commercialisation potential at project approval stage. There are a few final products that have been taken up by the private sector.

The extent to which development research/ activities are considered in planning projects		*		Sizeable proportion of the funds is allocated for development oriented applied research. But the outcome is moderate. More could be done.
The extent to which basic research are considered when planning projects	*			Basic research is strongly supported. Much appreciated by scientific community.
The degree to which adverse effects on environment are considered in planning projects		*		Adequate. Yet, more could be done. Clearance from relevant regulatory agencies are mandatory where applicable .
Additional observations (if any)				

iv.) Project Management and Maintenance of Quality

Proper project management and quality assurance/improvement practices are needed to ensure effective research operations, the quality of output and the 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.)	*			There is equitable sharing of resources between divisions based on need and past performance.

Ensuring that instruments, equipment and infrastructure facilities are sufficient for implementation of projects		*		After doing a need analysis NSF should ask for more funding for needed infrastructure.
The effectiveness of administrative procedures and support for project implementation (procurement and distribution of equipment and materials, transport arrangements, etc.)		*		Strong administrative procedures are in-situ. But Manual of Procedures submitted to DMS for approval not returned yet.
Formal monitoring and review processes are used to direct projects towards achievement of objectives		*		Some evidence for this. Intermittent restructuring evident. More could be done.
The extent to which the researchers are supported by the required technical / field staff.		*		Stakeholders are positive about NSF support. NSF can still improve this aspect.
Ensuring that established field / lab methods, and appropriate protocols are used		*		Not directly relevant to NSF. But ensured for research projects through the review process. Need for ethical clearance committee comes here.
			*	This happens rarely. Delay is primarily due to erratic disbursement of funds and logistic c/administrative con-straints in the host institution. Stake-holders suggest need for more flexible procurement guidelines.

		*		Excellent progress in this respect. Not all scientists are aware of what is available. Establishing a consortium of universities and research institutes to access all high quality databases is a must. Need to ensure these facilities are used widely among the academic community as well as the general public.
		*		There is a need to establish a formal quality assurance mechanism. Move to get ISO9001 is a step in the right direction.
		*		All scientific and most of technical officers have access to a computer with relevant software and internet access. However, there were few complaints about lack of essential software.
Additional observations (if any)				

v) Human Resource Management

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 the 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)			*	There is no staff database which is regularly updated. This is a must and a good practice.
The institution, plans and updates its staff recruitments based on program and project needs		*		The senior administration and Advisory Committees work on these regularly.
The effectiveness of the selection procedures and the schemes of recruitment	*			Proper mechanism is in place and Senior Management is involved with the process.
Training is based on institution and program objectives and on merit,		*		No training needs analysis. The staff is provided both local and foreign training as opportunities arise. Selection should be based on program need and merit/seniority.

The effectiveness of the procedures in promoting a good working environment and maintaining high staff morale.		*		Room for improvement. See the recommendations. A good Feedback mechanism should be established.
The effectiveness of staff performance appraisals		*		They are done, but can be better used.
The effectiveness of rewards and incentive schemes in motivating the staff			*	None available at present. Needs to introduce a rewarding system to motivate the workforce .
The effectiveness of managing staff turnover, absenteeism and work interruptions.		*		Does not seem to pose a problem at present.

Additional observations (if any)

NSF should introduce a suitable SOR, information storage and retrieval system. This will ensure data integrity. We further like to recommend SOP, namely, a standard operating procedure is a set of step-by-step instructions compiled by an organization to help workers carry out routine operations. SOPs aim to achieve efficiency, quality output and uniformity of performance while reducing miscommunication and failure to comply with industry regulations. It is time to have an experienced human resource manager whose position should be permanent.

v.) Management of Organizational Assets

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			*	Minimum political interference / has to work with limited funding which is not released on time.
Infrastructure (buildings, stations, fields, roads) is satisfactorily maintained.	*			Very good. Keep it up.
Vehicles and equipment (lab, field, and office) are properly managed and maintained.	*			What is there is well maintained. There was a complaint about lack of transport facilities.
The effectiveness of procedures to ensure that equipment are in working order		*		At the moment equipment is well looked after and maintained well.
The effectiveness of the institution's overall strategy in generation and proper utilization of funds		*		Hardly any strategy for generation. Utilisation of available funds is good. More could be done
The extent to which the institution identifies opportunities for income generation and cost recovery			*	Almost none. Need to identify more and more new funding sources.

The extent to which the intellectual property rights of the institute are protected			*	NSF did not get any "credit" for products. Publication rights are protected. Needs to be seriously addressed.

Additional observations (if any)

vi) Coordinating and Integrating the Internal Functions/Units/Activities

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		*		A new organizational structure and a staff cadre have been introduced. Needs improvement.
The effectiveness of internal communication and coordination mechanisms		*		Managed through regular meetings. Could be further improved.
Institution's overall direction and coordination are provided by a central planning committee / unit.		*		Corporate Plan gives the overall direction. Policy decisions are taken by the Board of Management. The management decisions are communicated to the Divisional Heads by the Director. Room for improvement.

The extent to which different units are assigned clearly defined functions		*		Functions of the Divisions are clearly demarcated and identified.
Responsibilities of research / management staff are clearly identified	*			Corporate Plan Identifies the responsibilities. Administrative responsibilities clearly assigned.
Effectiveness of using appropriate reporting procedures and feedback in management at different levels			*	Gap in communication between lower and higher levels of staff was noted.

Additional observations (if any)

vi) Partnership in Managing Information Dissemination

An important requirement of all S& T / Research & Development institutions is the management of dissemination of technology and information to users. The partnership / linking up with other actors in Science & Technology and information systems (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		*		It does. But the impact is mainly on the scientific community and not on the general public. Need to improve.

The extent to which the institution plans and maintains linkages with key partners for sharing and dissemination of information		*		Have many linkages with Universities and Research Institutions. Linkages with professional organisations and corporate sector need expansion.
The effectiveness of institutional procedures for technology transfer		*		Much room for improvement.
The effectiveness of the system to obtain feedback from different types of stakeholders		*		Feed back is obtained informally on an ad hoc basis. There is a need for formal systemic feedback.

Additional observations (if any)

Need to make use of new media such as Facebook, Twitter, You Tube and popular TV Channels too.

vii) Monitoring, Evaluation and Reporting Procedures

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, 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		*		It does as evident by intermittent restructuring and modification of cadre.

M&E is supported by an adequate management information system (MIS), which includes information on projects (e.g. costs, staff, progress, and Results).			*	Introduction of well structured manage-ment information system is imperative.
The extent to which S& T results and other outputs are adequately reported internally (e.g. through reports, internal program reviews, seminars)		*		Internal reporting does occur but needs to be strengthened to reach all levels.
External stakeholders contribute to the M & E process in the institution		*		By an excellent selection of a cross section of stakeholders in to the relevant committees, this has been achieved. Could be further improved.
The extent to which the results of M&E are used for project/ research planning and decision-making.		*		To some extent. Can further be streamlined through a well-structured data bank.

We also recommend that NSF should pay attention to some of the weaknesses identified in their own SWOT analysis and built on the Strengths and opportunities. Threats mentioned should be taken more seriously keeping up with the social weather situation in the county. Like in Manila, Philippines a social weather station can be also established to study the social weather in Sri Lanka, and it can become a think tank to give timely advice to relevant authorities.

Annexure - 1

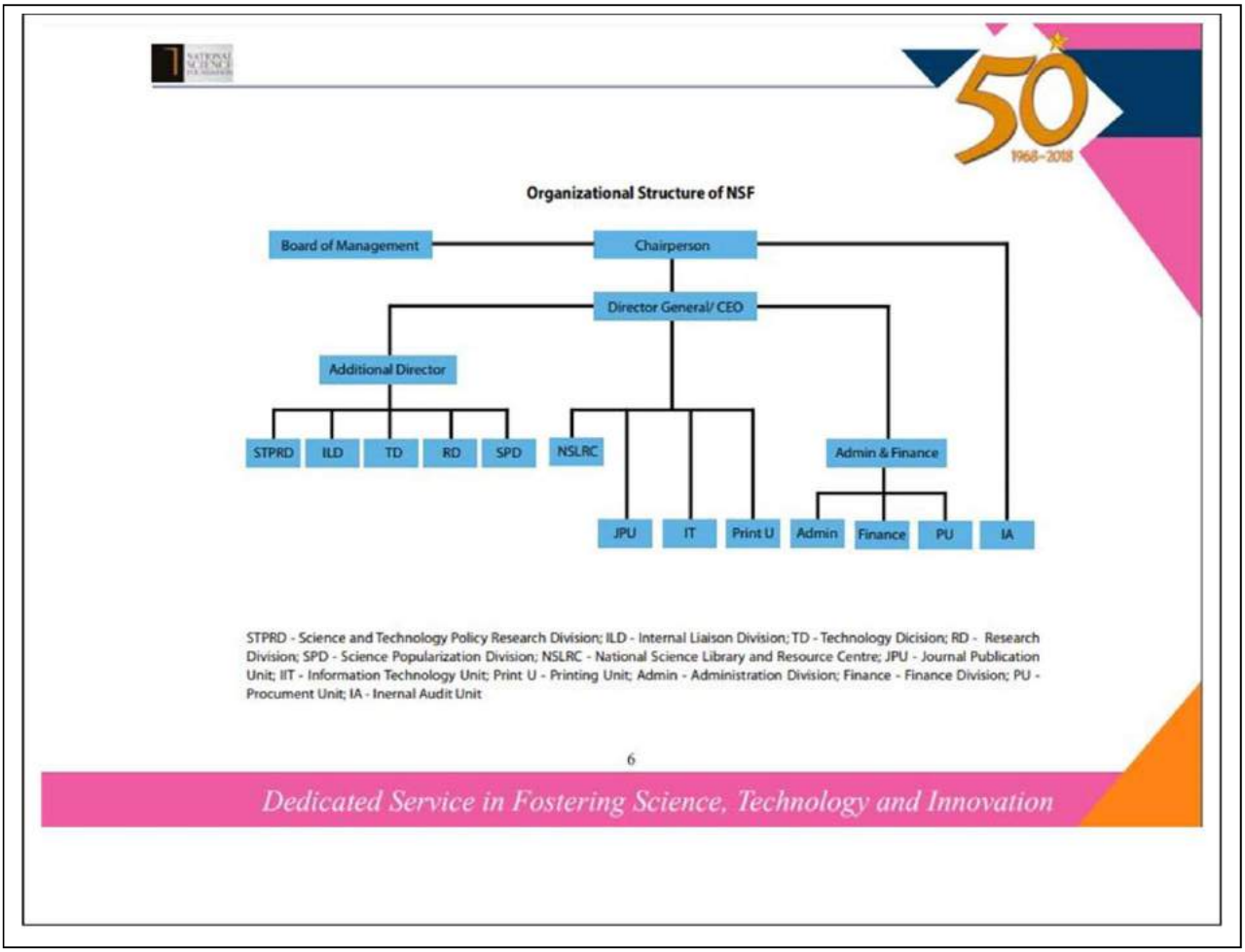
1. List of Documents Perused

1. NSF Web Site
2. STIMIS Data Base
3. Library Information System
4. Progress and ongoing activities of Printing Unit and VIDYA News Letter
5. Self-Assessment Report of the NSF (2017-19)
6. Review Manual NASTEC (2019)
7. Corporate Plan NSF (2013-2017)
8. Corporate Plan NSF (2018-2022)
9. Annual Reports NSF (2017-2019)
10. NSF Awards 2018
11. Report on "Govithanehi Hela Danuma" of Sri Lankan Scientists
12. Progress Report of Social Science Committee NSF 2013
13. Sample copies of JNSF, SLJSS, Vidurawa, and Supplementary Readers

Science & Technology Policy NASTEC &Mof S&T

15. Science, Technology& Innovation Strategy for Sri Lanka
16. NSLRC and other material such as 'Mihimadala'
17. VIDURAWA Science Magazine
18. VIDYA- News Letter
19. Conference Proceedings.

Organization Structure of the National Science Foundation



Annexure - 2

1. Photograph Evidence