Institutional Review:

Assessment of the National Engineering Research and Development Centre (NERDC)

Eng. Dr. S.A.K. Abayawardana
Eng. Dr. Mervyn Gunasekera
Eng. Prof. Niranjanie Ratnayake
Eng. Dr. Kamalanath Samarakoon
Mr. Damian Weerakkody

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The Contents

Abbreviations

BoG	Board of Governors
CEO	Chief Executive Officer
CPD	Continuing Professional Development
DDG(R&D)	Deputy Director General (Research & Development)
DG	Director General
DMS	Department of Management Services
ERD	External Resources Department
HoD	Head of Department
HR	Human Resources
ICT	Information and Communication Technology
IESL	The Institution of Engineers, Sri Lanka
IT	Information Technology
LAN	Local Area Network
MIS	Management Information System
NASTEC	National Science and Technology Commission
NERDC	National Engineering Research and Development Centre
PMU	Project Management Unit
R&D	Research and Development
RPC	Research and Planning Committee
RS/GIS	Remote Sensing/Geographic Information Systems
S&T	Science and Technology
SME	Small and Medium Enterprises
SCC	Salaries and Cadre Commission
SoR	Scheme of Recruitment
TMD	Technology Marketing Department
ToR	Terms of Reference

Acknowledgements

The Review Panel appreciates the confidence placed on them by the National Science and Technology Commission to carry out this review and also for the guidance provided to enable the review to be well harmonised with the Review Manual Guidelines.

The support by the NASTEC Acting Director Dr. Muditha Liayanagedera and Ms. Asha Pitadeniya, Scientific Programme Manager, who coordinated this review in numerous ways enabling timely completion of the work, is gratefully acknowledged.

The Chairman and Director General of the National Engineering Research and Development Centre, and their staff received us cordially and cooperated fully in carrying out this review. The Board of Governors spared their valuable time for a special meeting with us to exchange views and enable us to gain insights into the strategic directions for NERDC and the Board interactions with the executive staff. We are deeply appreciative of this cooperation and input by the Board, the Director General and the staff.

Valuable inputs were received from the Heads of Departments/Divisions and research staff as well as the union representatives and external stakeholders during the discussions, which proved quite useful in forming our professional opinion.

Executive Summary

The National Engineering Research and Development Centre (NERDC) was established in 1974 under the State Industrial Corporations Act No 49 of 1957 and having expanded over the years, now possesses some of the best engineering research facilities in the country in the fields of cost effective building construction, renewable energy, energy management, precision designing and manufacturing, electrical engineering and electronics, post harvest technologies etc. While some of the staff is well experienced and trained, low remuneration levels and factors such as the lack of senior colleagues for guidance and interaction, seclusion from the main activity centres of the country etc. have combined to adversely affect the recruitment and retention of new staff, resulting in a somewhat depleted human resource capacity.

This institutional review was carried out during the period June to October 2013 by an independent panel of five members appointed by the NASTEC with the concurrence of the NERD Centre. The general objective of the review was to assess how effectively the NERDC has acquired and utilised the resources to generate programmes and activities consistent with the mandate, and produce outputs that are relevant to its stakeholders and contributed to the national development efforts. The review mainly presents a snapshot view of the Institute's performance at the time, and does not reflect a historical view or a comparison of its performance over the years, although appropriate comments are made on such aspects where relevant. The review also presents recommendations for strengthening weak areas that could enhance its performance in the future.

The professional opinion of the panel was developed based on the general guidelines contained in the 'Review Manual – Procedure for Performance Review of S&T Institutions' developed by NASTEC. This required an assessment of the outputs of the institution as well as its management processes. The commencement of the review was based on a self-assessment report provided by the Institute covering the performance over the three year period 2009-2011. Since the review commenced only in the year 2013, relevant updates on the information was requested from the NERDC, which was readily provided.

As was the case with most public sector institutions, the NERD Centre had operated under serious constraints of staff numbers over the period under consideration, mainly due to restructuring needs dictated by the Department of Management Services and the Salaries and Cadres Commission. It was only in 2012 that the Centre could go ahead with any recruitment after a long period, somewhat easing the pressure. This, coupled with other difficulties in attracting engineers for recruitment, mainly inadequate remuneration levels for engineers, even compared to other public sector engineers and university lecturers, has eroded the HR base of research engineers in terms of quality as well, with only one M.Phil qualified engineer remaining in the Centre, with no Ph.D.s in 2012. Half of the research engineers are yet to become Chartered Engineers.

Funds, although somewhat low in allocation from the Treasury, had not been the limiting constraint in general. The Centre is otherwise well endowed with space and equipment for its operations.

Stakeholders positively commented about the good attitude of the Centre staff in providing services such as testing and certification, but highlighted delays largely arising out of resource constraints.

Overall, although there are isolated instances of significant input to the national economy, in general the number and level of technologies transferred with successful adaptation only reflect a position of partial achievement of its mandate; possibly seriously affected due to the constraints highlighted

above, but it is likely that improved management processes would enable a more impactful performance.

While significant resource input, better trained and professional staff and increased autonomy will clearly enhance the overall performance, the recommendations in the report are made to enable increased effectiveness in the delivery of the expectations within these resource constraints. The need to find solutions to the issue of failure to attract, recruit, train, and retain engineers by devising new approaches cannot be overemphasised for the sustained growth of the Centre. While it can take some action in this regard, the real solution is external to it in the hands of the line Ministry, and other higher authorities.

Detailed commentaries on the management aspects and outputs are given in Sections 3 and 4 of the report, and section 5 gives the reviewers' overall findings on the performance and recommendations for improvement. *These are summarised below but it is cautioned to view these in the context of some serious constraints faced by the Centre, as elaborated in the previous paragraphs.*

I. Strategic and Corporate Planning

A more formalised approach must be adopted for Corporate Plan development. Improved Board input in setting direction and providing strategic thinking in Corporate Plan development along with formalised stakeholder discussion and feedback is necessary. More emphasis should be placed to strategically address staff issues; attracting, recruiting, training and retaining key R&D staff is a prerequisite for the performance and development of the Centre. The adoption of an improved research planning process, where careful prioritisation and planning of research "Programmes" that address specific national goals/issues are included, would result in more effective outputs. Strategies to develop international collaborations, other restructuring opportunities such as separating 'Services' and 'R&D', and possibly setting up a Project Monitoring Unit need to be considered.

II. Programme Planning, Project Identification, and Implementation

It is necessary to develop a program orientation in R&D planning as opposed to a project orientation, where the tendency is to undertake ad-hoc disconnected projects. Programmes must necessarily meet national needs and the mandate. Projects must be identified based on the criteria that they fit into each programme and upon completion that they will collectively achieve the objectives set in the "Programme". A strong emphasis on formal stakeholder involvement from the project initiation stage and possible collaborative work is necessary in designing projects. In general, significant results can be achieved by working on a few large sized, high impact, multidisciplinary projects fitting into the programmes, rather than spend resources on a large number of small projects of low impact.

Provision of formal training to the staff in R&D projects formulation, planning and management, and writing project proposals would be useful. Detailed documentation such as guidelines on filling project proposals need to be developed. The rigour with which the R&D process is managed can be improved. The completeness of proposals presented to the Research Planning Committee (RPC), critical review by the RPC, and the criteria used and the approval standards set by the RPC need to be tighter and require improvement.

The membership of the RPC which is constituted only of internal staff members is not quite correct or suitable. Board Members are invited to attend, but is not quite regular in attendance. It is suggested that external stakeholders, particularly researchers, industry experts, and some Board members are included formally in the membership.

III. Technology Transfer and Extension Services.

The communication between the R&D Departments and the Technology Marketing Department (TMD) is somewhat linear, both in transferring projects and in receiving feedback. While retaining some of the formalities necessary for quality assurance, more frequent and direct communication, and at times even informal communication, will improve the effectiveness of the technology transfer process. Seamless communications throughout the project life on a continuing basis across the R&D departments, TMD and the stakeholders must be established and encouraged.

Strengthening the TMD with a marketing outlook, with a more vigourous outward oriented proactive approach to exploit the R&D outputs will yield better results. The present predominant approach of newspaper advertisements calling for expressions of interest to use the products and technologies for commercialisation is somewhat limiting. TMD can be further evolved to an innovation centre where entrepreneurs are facilitated with funding and business knowhow.

It is good to evolve methodologies for closer direct interaction of Centre R&D staff with customers during the initial transfer process and the inception phase of the operation, rather than limiting this interaction to the TMD, as it will enable improved technical support for troubleshooting, resulting in faster adoption. This will also generate more confidence on the technologies developed among the customers.

The current licensing fee structure needs to be reviewed, as the purpose of the present scheme seems to be ambiguous, being too low for even the recovery of costs. The corporate thinking of the Centre as to whether its outputs are provided to the end user as a public service, in which case it could be provided either free or with a nominal charge, or whether to charge a meaningful sum at least as a cost recovery mechanism has to be established. This will be an important decision to be made for future development of the Centre, in the light of the recent move towards operation of the Centre as a business enterprise.

IV. Human Resource Management

Substitution of the present manual systems of HR management with an Integrated Human Resources Management system at the HR Department will ensure efficient and effective service delivery with less recurrent cost.

The Centre needs support and approval from higher authorities to strategically address staff issues in terms of attracting, recruiting, training and retaining key R&D staff as the highest priority. It is stressed that unless a solution is found for the issue of unsatisfactory remuneration, the long term sustainability of the Centre is clearly at risk.

Training approaches need to be fast tracked to develop high level researchers; currently there are no Ph.D. qualified persons, and only one M.Phil. qualified person is available. It is however not a prerequisite to have higher degrees other than a Masters (or the Chartered Membership of IESL or equivalent) to move onto higher research grades according to the SoR. It is perhaps good to review this to aim for a mix of Chartered Engineers and personnel with higher research degrees at the higher levels.

Strong emphasis should also be placed on staff development in collaboration with international institutions. This enables exposing and training of Centre staff using international Centres; a necessary tool to be adopted to ensure that the staff is well abreast of modern technologies and research methods.

There appears to be an imbalance of staff categories, favouring the lower categories. Therefore right sizing of staff through proper manpower planning and recruitment as required will be helpful.

NERDC also needs to pay attention to establishing a strengthened research leadership, an imperative in motivating an institute such as this.

The performance appraisal system at the NERDC is neither linked to gap identification nor career advancement of the staff. Therefore an appraisal system that provides every individual to involve in goal setting, regular progress monitoring, identifying gaps and directing for career advancement should be introduced.

V. Documentation, Knowledge Management and Management Information System

NERDC operates an effective financial information management system where every research staff member can obtain the financial information about each project on a current basis. A similar information system comprising a good comprehensive database and a documentation system on the research projects, their progress and status, and outputs need to be established. The impacts or benefits arising from the projects also can be included in this database. This will not only help manage research better, but will also develop into a useful compendium as a corporate marketing tool. The final reports produced on completion of projects should be improved substantially as it is the final outcome of the project that will preserve the knowledge gained for further work.

VI. Communication and Information Dissemination

While the focus should be on Technology Development and Transfer on the ground, dissemination of research findings is normally through publishing in learned journals and national and international conferences. This is a necessary tool to elevate the professional approach of the centre staff.

The Centre can also better make use of its website to its advantage by making it more interactive, current and user friendly, by introducing social networking media such as blogs and forums, to disseminate information, get customer feedback, provide advice to the users of the NERDC technologies etc.

In the case of popularising technologies amongst rural target audiences, use of existing government channels such as the Vidatha Centres, Nana Salas, or the Provincial Secretariats and Grama Niladharis may be an option.

Wide use of teleconferencing / video conferencing / Skype would help the communication with other research institutes and universities very conveniently and the staff will be motivated to be on par with the rest of the world in IT and communications.

The internal communication among the various Departments of the Centre has to be improved, so that the projects and programmes can be carried out seamlessly. Multidisciplinary teams should be encouraged.

VII. Organisational Assets

Knowledge loss through turnover of staff can be considerable and does affect the progress of the projects. A strong, well designed knowledge management/ documentation process therefore is a prerequisite. The approach of establishing team oriented projects will also alleviate this problem somewhat. Physical and financial assets are reasonably well managed.

1. The National Engineering Research and Development Centre

The National Engineering Research and Development Centre (NERDC) was established in 1974 under the State Industrial Corporations Act No 49 of 1957 with the primary purpose of *"developing, acquiring, adapting and transferring engineering technologies that would help in the production and sustainable utilisation of human and material resources by engaging in R&D activities that would have a direct impact on the economic development of Sri Lanka and on the improvement of the living standards of the people"*

Initially, the NERD Centre operated at Kollupitiya and in 1978 it was shifted to a more spacious location at the Ekala Industrial Estate enabling expansion of its activities to address additional important areas of R&D such as cost effective building technology, renewable energy technology, and environmental aspects.

Since 1974, over the last four decades, the NERD Centre has grown both in size and stature. Today it is a very important engineering research Centre in the Country. The Centre now possesses some of the best engineering research facilities in the country in the fields of cost effective building construction, renewable energy, energy management, precision designing and manufacturing, electrical and electronics, post harvest technologies etc. While some of the staff is well experienced and trained, remuneration levels and other factors have combined to adversely affect the recruitment and retention of new staff, resulting in a somewhat depleted human resource capacity.

I. The Mandate of the NERDC

The mandate of the Centre, as derived from the act and as presented in the Self Assessment report is as follows:

a. To provide for an institutional mechanism needed for the progressive development of indigenous technology by encouraging, recognizing and developing innovative and creative talent in Sri Lanka.
b. To provide facilities to co-ordinate the technological, engineering and research capabilities of various public and private sector industries and institutions in a productive manner through co-operative endeavour,
c. To ensure by adoption and adaptation the choice of technologies that would be consistent with the country's resource endowments and national planning objectives;
d. To examine direct and indirect mechanism of technology transfer and offer counsel to appropriate government and private institutions in Sri Lanka, when required to do so;
e. To promote the optimal exploitation of the country's human and material resources, particularly labour and raw material resources by promoting the growth of suitable technology;
f. To design, manufacture, and test prototype machinery, pilot plants as demanded by industrial, commercial and other end-users in an economical manner.
g. To provide for continuous monitoring of technological data and documentation relating to engineering designs and research through the co-operation of international and national agencies;
h. To offer sustained consultancy services to public and private sector enterprise and undertake research and promote training activities to broaden the base of the country's engineering and industrial design and research capabilities.

II. The Vision of the NERDC

The Vision of the National Engineering Research and Development Centre is …..

"To be a Centre of Excellence, in Engineering Research and Development in South Asia and to be able to make substantial contributions towards the sustainable economic and social development of the people of Sri Lanka through engineering interventions"

….Corporate Plan 2013-2015

III. The Mission of the NERDC

The Mission of the National Engineering Research and Development Centre is…..

"To develop, acquire, adapt and transfer engineering technologies that would help in the production and sustainable utilisation of human and material resources by engaging in R&D activities that would have a direct impact on the economic development of Sri Lanka and on the improvement of the living standards of the people"

…Corporate Plan 2013-2015

IV. Governing Ministry

The NERD Centre is under the purview of the Ministry of Technology and Research, formerly Ministry of Science and Technology. It had continued to function under this ministry from the inception.

V. Sources of Funding

A high proportion of NERDC funding is from the Government; with a smaller portion (~15%) met from internally generated funds, earned through consultancies and professional testing services. There is an increase of the allocated budget from Rs. 158.5M in 2009 to 218.5M in 2011. Capital budget during the same period increased from Rs.80M to Rs.88M, somewhat of a lower increase, compared to the recurrent budget.

VI. The Context

The opinions expressed and the contents of the report present a view and make recommendations aimed towards achieving the full potential of the Centre, notwithstanding some underlying serious constraints under which the Centre operates , which have to be taken note of in interpreting or drawing conclusions from this report. Many of these constraints arise from external factors and frequently the Centre has little control over them. It is the intention that the Centre notes these recommendations and exercise diligent innovative approaches in reaching its objectives.

A primary resource constraint faced by the Centre is the strength of its staff both in numbers and in the level of qualifications and experience. In 2012 although out of a cadre of 303, 269 numbers were on the payroll, for professional staff this proportion is quite bad with only 31 filled out of a cadre of 72, i.e. 41 positions or 57% of the cadre vacant. There is also a serious inadequacy of middle level professional staff who can be developed to take over senior positions in the short to medium term.

It is clearly very difficult to recruit and retain the right type of Engineers and other staff of the right calibre at the current public sector remuneration levels, particularly considering the prevailing market conditions for engineers, not only in the private sector but also within the public sector itself. Ironically, even the allowance granted to engineers in the public sector is not made available to engineers at the NERDC, due to the fact that appointments are not being made by the Engineering Services Board. This is compounded by the directives emanating from the Department of Management Services, where the need for a new restructuring and re-categorisation of employees has come into play from around 2007, requiring approvals from them and the Salaries and Cadres Commission which were quite long drawn out, in effect stifling recruitment over the last few years. It is only in 2012 that permission has been obtained to recruit engineers. Even then the attempts at attracting and recruiting the right type of staff have not been very successful. Many of the vacancies have been filled with internal promotions from the Technician grade, as allowed in the newly approved SoR. This state of affairs with respect to recruitment has impacted the Centre badly exemplified by the severe shortage of senior personnel of high calibre; for example the Centre has only one M.Phil. qualified principal researcher in 2012 and no Ph.D. qualified engineers. Experienced chartered engineers fill this gap somewhat, but the people, structures and systems in place do not augur well for the future too in planning for the development of a competent high-calibre research staff base.

The limited allocation of Treasury Funds and the timing of disbursements are not quite conducive in developing and executing the necessary plans for an efficient operation. Out of a capital allocation of Rs 81.9M only Rs 30.3M was received during 2012; of the recurrent allocation of Rs 160.7M, only Rs 144.8M was received. One could also argue that the slow release of funds is due to lower expenditure by the Centre, but the Centre's inability to plan for expenditure according to the allocation due to non availability of timely funds must also be recognised – creating a vicious cycle of sorts.

2. The Review Procedure

I. The Panel and the Methodology

The performance review was carried out by an independent panel of five members, appointed by the National Science and Technology Commission (NASTEC) in consultation with NERDC. The Panel comprised:

Eng. Dr. S.A.K. Abayawardana Chairman	Program Director, Coordinating Secretariat for Science Technology and Innovation; Former Director, National Science Foundation; Former Head/Sri Lanka Program, International Water Management Institute; Former Technical Director, Unilever Ceylon Ltd.
Eng. Dr. Mervyn Gunasekera	Chairman-Union Chemicals Lanka PLC, Managing Director-LAN Management Development Service, Past President of the Institution of Engineers Sri Lanka and the Federation of Engineering Institutions of South & Central Asia.
Eng. Prof. Niranjanie Ratnayake	Senior Professor in Civil Engineering and Former Head of Department, Department of Civil Engineering, University of Moratuwa; Vice President, Institution of Engineers Sri Lanka.
Eng. Dr. Kamalanath Samarakoon	Senior Lecturer, Dept. Of Computer Engineering, Faculty of Engineering, University of Peradeniya, Former Chief Engineer, Ceylon Electricity Board.
Mr. Damian Weerakkody	Manager/Human Resources, Tradesmann SL pvt. Limited, Former Manager/ Human Resources and Administration, MAS Holdings and Serendib Flour Mills pvt. Ltd.

The general objective of the review was to assess how effectively the NERDC has acquired and utilised the resources to generate programmes and activities consistent with the mandate, and produce outputs that are relevant to its stakeholders and contributed to the national development efforts.

The members of the team were quite conscious of the fact that while the review report must address the needs of all concerned parties, such as policy makers, the relevant line Ministry, and the Treasury, its most important function is to guide the Institution being reviewed towards self-improvement, at the institutional, programme, project, and individual levels. The team has done its utmost to ensure that the analysis, findings and the recommendations are evidence based as far as possible, and carried out in a completely unbiased manner, and presented constructively.

The professional opinion of the panel was developed based on the general guidelines contained in the 'Review Manual – Procedure for Performance Review of S&T Institutions' developed by NASTEC. This required an assessment of the outputs of the institution as well as its management processes.

II. Pre Assessment

A number of basic documents were made available to the panel by NASTEC;

- Review Manual – Procedure for Performance Review of S&T Institutions
- Self-Assessment Report prepared by the NERDC management
- The Terms of Reference for the Review

Following a study of these documents, the panel met on 30th May 2013 for a preliminary discussion to clearly understand the ToR and map out its review activities. Further documentation support was requested;

- Annual Reports- last 5 years
- Final reports of a few key projects
- Scheme of Recruitment
- Performance Appraisal Formats
- Corporate plans
- Act under which NERDC was established

III. The Assessment

The review programme comprised;

- A review team meeting on 30th May 2013 at NASTEC for a briefing by the Acting Director, NASTEC on the terms of reference and a preliminary discussion among the Panel Chair and members.
- A second meeting on 14th June 2013 at NASTEC to discuss the operation and performance of the Centre based on available material and to schedule its planned review activities.
- Review visits by the team to the NERD Centre over two days, 25th June 2013 and 4th July 2013. The visit commenced with a meeting of the entire senior management team of the Centre with an introductory presentation by the Director General, followed by visits to all Departments of the Centre and discussions with the relevant staff.
- A meeting with the NERDC Board of Governors on 9th July 2013.
- Separate meetings held with trade union representatives on the same day.
- A meeting with stakeholders in a Meeting Room at IESL on 25th July 2013 where a limited number of stakeholders were present. Fifty were invited and fifteen were present.
- Further discussions, and follow up requests for documentation from the NERDC as necessary.
- Collection of additional documents during the discussion for information and validation.
- The review team discussions and meetings on 13th August 2013, 29th August 2013, 20th September 2013 and 17th October 2013.
- A verification visit made to the Centre again on 7th November 2013
- Presentation of the draft report to the NASTEC in December 2013 to seek views and comments from the Director General, NERD Centre.

IV. The report

Based on the findings, different sections of the report were prepared by team members and collated and finalised based on a series of team meetings and e- mail communications. The final document was prepared by consensus with the agreement of all team members. The opinions expressed and the recommendations made are therefore collectively decided by the panel.

3. Commentary on Management Assessment

The ability of an institution to produce useful and relevant outputs depends on internal policies, strategies, management practices and the way in which these are applied. The NASTEC Review Manual identifies nine management aspects along with the salient features of each management aspect that are applicable to S&T institutions in general (for the most part applicable to the NERDC as well). The management review was carried out based on these aspects and the following paragraphs summarise the key points identified as the Institute's strengths and weaknesses in each area leading to the recommendations in Chapter 5. As these aspects frequently have overlapping elements, a degree of repetition may be evident in the commentary below; this is however kept to a minimum. The relevant analysis tables of the management processes are given in Appendix 1.

I. Assessment of institutional response to external and internal environment in planning organisational strategies

The organisational strategy is reflected in the Corporate Plans and the Strategic Plans of any Institute. NERDC has a Corporate Plan which is updated annually for the ensuing three year period on a rolling basis. The review panel had the opportunity to study the Corporate Plans for 2009-2011 and 2013-2015. NERDC had also developed a Three Year Business Plan at short notice in 2013 with the objective of achieving self-financing status in the future, as requested by the Ministry.

It was evident that the updating exercise of the Corporate Plan to a large extent amounted to a non-formal routine exercise without much stakeholder discussion and input. The Heads of Departments and the senior staff are involved, but the involvement and input from the general staff is inadequate, other than perhaps the informal input given to Heads of Departments. The Government/Ministerial policy directions are taken into account, mainly with the awareness and feedback from the Chairman and the Director General who attend regular Ministry meetings. A greater degree of involvement of the Board of Governors' in setting directions for the Corporate Plan would have been more effective. They get involved towards the latter stages in reviewing and approving the strategic and activity plans.

The Corporate Plan for 2013-2015 shows a departure in terms of the Goals and Strategies set out from the earlier plans, and outlines a set of reasonably high level strategies with Goals fully aligned to the National S&T Policy Goals. The objectives outlined in the same Corporate Plan however are not in line with these Goals, as probably it was difficult to present these in full alignment with the National S&T Policy Goals. In addition, as a result a mismatch is evident between the Goals and the Activity plan, leading one to surmise that more care and attention is required in the development of the plans. The connectivity between this plan and resource planning such as HR, Plant & Equipment and finance is also not clearly evident.

Although the response of the Centre to changes in government policies is reasonable, stakeholder discussions that allow them to fully reflect their views and needs at the planning stage seem to be inadequate. If stakeholder participation was adequate, more demand oriented activities with private sector collaboration and a service orientation would have been evident.

II. Planning S&T programs and setting priorities

It is found that most of the projects carried out by the NERDC are standalone projects and not a part of larger programs designed for broader objectives. The Ideal situation would be to identify a few nationally relevant programs with high social impacts, such as renewable energy, climate change adaptation, sustainable construction materials and technologies etc., with fairly large multidisciplinary research teams, and develop the individual projects under these programs. Low cost building projects and bio-gas projects are some of the projects that can be considered as falling within the concept of such "Programs. Projects within the renewable Energy Department can be made to fit into a program; however they still tend to be somewhat fragmented. Perhaps the recently started program on machinery for processing Ayurvedic medicines also fits into this category.

Having broader thematic programs with many interrelated projects collaboratively carried out by many researchers would be helpful to build up a knowledge pool within the NERDC, share resources and would redress the issue of knowledge loss due to high turnover. Even if a couple of members were to leave the NERDC, the program could be continued with the help of remaining researchers and modified teams with the retained knowledge.

Although national benefits are mentioned when justifying a project, it is evident that the ad-hoc nature of project identification and planning does not lend itself to adequately orient the outputs to these goals. As a national research institute, considering national goals is an essential requirement. The impact of each program in achieving national goals, the type of socio economic groups that would be benefitted by the program, what percentage population is benefited nationally etc. should be assessed prior to approval. Having a programmatic approach to research planning as opposed to a project approach will help align the outputs more closely to national needs.

III. Planning Science &Technology / Research & Development Projects

Project initiation at NERDC is mainly at the department/individual level. Many projects are proposed primarily due to personal interest of individual researchers and/or ad-hoc requests by individual stakeholders. With the Centre's core business being delivering outputs from research to contribute towards addressing national needs, it is essential that suitable research planning methods are developed to satisfy this need. The ad-hoc project development currently in practice does not satisfy this. The research planning and prioritisation mechanisms in place do not adequately offer opportunities for collective contribution by staff members. In general, there are no opportunities as well for Stakeholders to be formally involved adequately in project identification/planning.

A format is available for presenting project applications to the RPC. However it was observed that frequently, the required information is not presented in adequate detail in these forms to assist the decision making process of project approval. Inadequate/incomplete applications are presented perhaps because the staff had not received formal training on planning S&T projects. Also it would be helpful if a guideline is prepared describing what should be included in each section of the application together with a sample project plan to show what and how the information should be presented in the project proposal.

It is also noted that the evaluation process does not question the shortcomings in applications and frequently overlook these when approving the applications. RPC frequently approves projects where the proposals appear to be incomplete at the time of approval. For example the minute of the April 11, 2013 meeting indicates that the Cattle feed project was approved but the development of a collaborative approach is recommended, Biomass stove project was approved but requires the development of a work plan with milestones, foot bridge program was approved but requires the submission of a revised project programme, thus allowing significant elements of the proposal to be developed after approval.

The format and the membership of the RPC are not conducive for such questioning too. Since all the staff members are present at the RPC meeting, it may prevent close scrutiny and critical questioning of the applicant/s. Presence of all research staff members may be good as a learning opportunity for the members but it is not helpful for the project planning. It is also to be noted that the RPC does not have any external members.

Techno Marketing Department is the interface between the stakeholders and the NERDC. Therefore TMD is expected to know the state of the past research projects whether the technology has been transferred successfully and the shortcomings if any, and also future needs. However, it is found that the involvement of TMD in project planning is not adequate. Such involvement in a seamless manner is helpful to ensure that the projects are designed to meet specific stakeholder needs or even to clarify the viability of the proposed product.

After a project has been completed, it is handed over to TMD for marketing and licensing. However by the time TMD receives stakeholders' feedback for required modifications, the project cycle is over and it is closed. Although there is still some room to allocate resources for addressing deficiencies of the product or to modify the product to accommodate essential features requested by the stakeholders at this point, there is a general feeling that this approach does not allow full support to the transferred project. Therefore, when planning projects, it will be good to include provisions in the project plans to accommodate changes and improvements during the transfer/adaptation stages.

It was noticed that, even the deficiencies of the newly developed products are reported to the relevant Department by the TMD through the formal channel; there was no evidence to show the existence of formal joint review meetings between the Departments and the TMD to address these deficiencies.

After the technologies are transferred to licensees, the state of the licensees to assess whether they are marketing the products successfully or not should be evaluated. The review panel did not find evidence of performing such formal assessments by the TMD, other than some specific follow up instances.

IV. Project management and maintenance of quality

The NERD Center mostly carries out individual projects (eg. motorized manioc slicers, development of industrial biomass stoves etc.) and a few programmes which consist of multiple projects (eg. building constructions including building components, construction of number of biogas units etc). Effective project management requires the achievement of project goals within the scheduled time frame and budget allocation meeting the required performance/ quality parameters. The management of a project consists of four activities, in particular: Planning, Organizing, Controlling, Leading and Motivating.

A monthly project review meeting is held by the Deputy Director General (Research) with the presence of Heads of Departments, but it is noted that a critical review of the projects is not possible at this meeting due to the large number of projects being reviewed within a limited time and does not enable driving the projects effectively.

It was therefore evident that handling of the above management tasks can be improved substantially, with a more professional approach. It was also observed that a considerable number of projects were facing problems relating to cost and time overruns. Furthermore, some projects were abandoned during the execution phase.

It is also important to develop a database (eg. time taken, expenditure, lessons learned etc) from the experience of previous projects so that the information could be used in programming, resourcing etc. in future projects.

It was evident that except for testing services, there are no established procedures for quality controlling of the research work and other services rendered by the Centre. Quality control procedure should also be applied to the quality of documents prepared by the Centre. (eg. project proposals, project completion reports, approval forms and assessment reports).

V. Human Resource Management

The constraint of poor human resource strength is a key impeding factor for technology generation and dissemination at NERDC. Prevailing high turnover rate of 22% among R&D staff has become detrimental to the productivity of the organization as they take out critical knowledge while incurring a high replacement cost. The average retention of R&D staff during the past four years amounts to 56% of the total approved cadre. Among the key drivers for high turnover of research engineers, low remuneration levels and constraints in the working environment including poor accessibility remains at the top of the list.

It was evident that poor relationship among different staff categories is a key impediment for encouraging team culture within the NERDC. Newcomers feel that they need more systematic guidance and there are inadequate opportunities for career development leading to dissatisfaction among R&D staff to a certain extent. This emphasizes the need for strengthening team culture among diverse staff categories and setting the tone for high morale and motivation by the leadership.

The recruitment and selection of staff follows the SoR approved in 2012 yet the R&D and the technical categories remain understaffed by 57% and 29% respectively by year 2012. SoR has both pros and cons. It has made the recruitment and selection procedure more convenient, helped maintain the uniformity and ensured transparency of selection process though it has failed to retain talents due to low salary scales when compared to other parallel institutions. Longer time taken for promotions is a greater concern among all categories of employees, but this appears to be an inherent requirement in the DMS unified SoRs. It is also not a prerequisite to have higher degrees other than a Masters (or the Chartered Membership of IESL or equivalent) to move onto higher research grades according to the SoR. It is perhaps good to review this to aim for a mix of Chartered Engineers and personnel with higher research degrees at the higher levels.

Staff development is limited to few opportunities conventionally offered by the External Resources Department (ERD) and there have been hardly any initiatives to explore additional training opportunities. This is needed to equip the R&D and technical staff with the required knowledge, skills and especially positive attitudes that lead to increased employee engagement which is a necessary element for employee retention. The HR-to-employee ratio at the Centre is 1:22 thus the HR Department has an adequate cadre of human resources. However it performs within the given scope amidst a variety of regulations. As a result NERDC has a severe shortage of trained staff at postgraduate levels, a prerequisite for a knowledge organization to earn an increased recognition among diverse stakeholders. New R&D staff should be provided the opportunity to undergo thorough training on research methodology including research program planning and proposal preparation to circumvent this problem. Senior staff can also benefit from refresher programs.

A basic performance review format is used, but not quite effective in providing candid feedback aligned to employee advancement. It also does not have provisions for differentiating high performers from under performers. Given these constraints one of the appropriate options to motivate the staff is rewarding good performers through an appropriate incentive scheme, geared to ensure each contributor is benefited proportionately to his/her contribution.

VI. Management of Organisational Assets

The NERDC seems to be resourceful in terms of funds, infrastructure, vehicles and equipment. However the poor strength of R&D staff seems to be impeding the performance of NERDC in accordance with its mandatory functions and statutory powers. There is therefore a strong need for designing and execution of an all-encompassing strategy that would utilize the available resources to bring forth tangible benefits to the nation in the short-medium-long run.

Adequate inputs and processes are in place at the NERDC for maintenance of infrastructure satisfactorily. The present maintenance system ensures vehicles and equipment are in working order. Further improvement in physical outlook of the Centre may contribute to increased satisfaction of stakeholders both internal and external.

In spite of the fact that the Centre has managed to reasonably protect its intellectual property rights, the inability to retain staff and the consequent staff loss frequently results in knowledge loss as well, adversely affecting the progress of projects.

Fund utilization too remains at a higher level amounting to an average of 86% of the allocation for the last three years, with a lower percentage utilization of the capital allocation at around 70%. The fact that how effective is the fund utilization is a matter of how and to which extent the technologies developed are aligned with national development needs which requires in-depth studies to assess.

The NERDC was established to serve the purpose of generating and disseminating engineering solutions of a public service nature for the development of the country at large. Given this context it is to be questioned whether the recent directions for income generation and cost recovery would undermine the very purpose of establishing the NERDC. At the moment NERDC has an income generation amounting to 15% of the total budget particularly through consultancy and professional testing services. Any future directions of NERDC for income generation should not sacrifice R&D work, in preference to the testing and consultancy services. Rather, it should complement and strengthen R&D which is the fundamental mandate of the NERDC.

VII. Coordinating and integrating the internal functions/units/activities

The Corporate Plan of the NERDC 2013-2015 has identified conducting a needs assessment survey and identifying priority areas for research and development to match facilities available at the Centre and promotion of multidisciplinary collaborative research with private and public organizations as strategies for achieving Goal 3: To promote Engineering Research and Development in the areas of national importance and priority. It is necessary to improve the processes to effectively translate these strategies into actions in the Corporate Plan. Multidisciplinary approach should be encouraged in the conduct of research, with research groups formed across the disciplines, in order to achieve better results. Interaction among different Departments needs improvement and will enable more relevant outputs from the Centre. Feedback from the TMD is not effectively received by the respective Departments for product improvement, as the project is closed at the time of handing over to TMD. Follow-up of transferred projects by the TMD with the involvement of the respective research department will be helpful in ensuring the success of the transfer. Management information in respect of project budgets and expenses is available but does not appear to be used by Departments for self-monitoring - monitoring is mainly done centrally by the DG/DDG. Inter-relationships among the employee groups – such as engineers and technical staff, appear to be poor as seen during the discussions with Trade Unions.

Although the roles of the various departments and units seem to be adequately defined, due to various reasons cited such as keeping the employees occupied and earning extra income, there seems to be overlaps and duplication of work, such as construction activities by mechanical engineering staff, research staff of the electrical engineering department being employed for routine maintenance work etc. These deviations from the core business of the Centre should not affect the performance of the departments from active involvement in research and development of national importance. Having workshops in individual Departments in addition to the Central workshop may be an advantage provided there is coordination to avoid unnecessary investment on expensive equipment.

There is little guidance on research for the junior staff as the senior staff numbers are quite low, and there is no evidence of mechanisms that exist to draw on external inputs from qualified researchers. The management should insist on regular progress monitoring of the projects undertaken against clear performance indicators laid down in the research proposal, and the management/senior staff could establish methodologies to co-opt qualified researchers from the Universities, other research institutes and the private sector to work on projects and guide the junior staff.

VIII. Partnerships in managing information dissemination

The goals and objectives in the Corporate Plans for 2008 - 2012 and 2013 – 2015 lay out certain strategies related to dissemination of information, but they are not reflected well in the action plans over the years. The most regular mode of dissemination of knowledge is through training programs conducted at the Centre for various groups of stakeholders. The Centre is quite well known in society and it maintains its visibility through participation at exhibitions, information sharing through leaflets and brochures etc. However, publication of research findings in learned journals, which is an essential feature of the process of conducting research, is not regarded as a responsibility by the engineers, although there is an internal incentive payment for researchers who publish articles. Newsletters are published sporadically. There are no formal linkages with

other relevant government organizations like SLSEA, Universities, ITI etc. This was admitted during the meeting with the Board of Governors, being attributed to the reluctance of sharing information, which is a common occurrence in Sri Lanka.

Techno Marketing Department is responsible for technology transfer. Records are kept up to date and procedures for technology transfer are laid down, but better results could be realized by adopting market oriented innovative approaches in taking the outputs to the stakeholders. Training of staff in these aspects would be useful.

No regular stakeholder meetings are held to get their ideas on improvement of products, new concepts to be developed or optimize the resources available to improve the outputs from the Centre. The stakeholders we met had many constructive suggestions which could have been used to the benefit of the organization. Unfortunately, feedback for product improvement obtained by TMD from the users does not get back into the project cycle effectively. The technology transfer packages appear to be fairly comprehensive, but are only produced in the English Language. It is strongly recommended that the Technology transfer packages are translated into Sinhala and Tamil, as the SME sector would be more comfortable in following instructions in their own language.

Sinhala and Tamil versions of the website are not functioning. In the English site, the information about the projects is incomplete and not up to date. As per the website, there are about 42 ongoing projects and only six successful projects. Technology details are available only for four projects. Link of Technology Park gives only the contact details and ticket price. It would be better to include information about the exhibits that would attract more visitors. Information about the patents filed/received after 2002 is not given. Information about the awards and achievements received after 2007 is not given. Simply put, the website can be improved quite considerably.

The information is disseminated through seminars and exhibitions. However there is no regular form of awareness program or advertising campaign that would reach potential clients who need to get information about the products. Many products are developed to cater for low income or village communities, and these communities have less access to the exhibitions mostly held in Colombo and probably have no access to the Internet.

The Technology Park, originally set up as a demonstration site of technologies developed for the potential entrepreneurs, is now used more as a science popularization/awareness unit for schools and the general public. The newly built Museum of Technology is a very interesting additional resource for knowledge dissemination and popularisation of Science and Technology.

IX. Monitoring, evaluation and reporting procedures

Unless there is an effective monitoring system established and maintained, there is no guarantee that a project will be completed meeting its goals. (ie time, budget and performance parameters).

Financial reports are available with the Director Finance showing budget allocations and expenditure of project activities. This is also available in the internal network but does not seem to be used widely by the Departments. The present practice of stopping funds when overrun, without a formal extension, is a good strategy for forcing the researchers to be more aware of allocations and expenditure.

A monthly physical progress report is generated, but it does not give adequate information/data for effective monitoring of the projects. These reports can be improved to project the following information on a clearer basis.

- Is the project on schedule or ahead of schedule?
- If the project is behind schedule, what are the activities contributing to delays and who is responsible?
- Is the project on budget?
- If the project is over budget what are the activities contributing to cost overruns and who is responsible?
- Is the scope still the same?

A standard assessment form can be developed taking into account these parameters.

No evidence was available to show that monitoring, evaluation and reporting procedures are integrated into project planning and periodically reviewed in the decision making process and establishing accountability.

Details on the portfolio of projects, both current and historical, were not readily available other than through personal knowledge of seniors and their own records. A well managed documentation system therefore is a prerequisite.

4. Commentary on Outputs

In examining the outputs the Panel focused on the delivered 'outputs' and did not undertake a detailed review of the activity plans and their progress for the corresponding years. An overview of the activity plans was however noted in the context of the programs and plans of the Centre.

I. Activity Plans

It is noted that the activity plans did not correspond well with the Goals outlined in the Corporate Plans and even when they do correspond, their alignment to the Goal was not well illustrated. In general, the activity plans include a large number of activities/projects, which appeared to be quite in excess of what the Centre can undertake within the present limited resource constraints, particularly Human Resources – 41 positions (or 57%) of a professional cadre of 72 vacant in 2012. One can argue that the Centre expected these to be resolved, and that planning was based on the expected recruitment, but it is clear that a more realistic and a pragmatic approach should be taken in such constrained situations. For example the 2013 activity plan has 54 items, quite a few of them being substantial projects, while some fall into the category of services/dissemination activities/ consultancies, all requiring the input of the same scarce personnel. One could argue that 54 activities is within the capabilities of the 31 research engineers present, but when considering the experience and seniority levels of the personnel available this can be rather daunting.

II. Overview of Outputs

The actual outputs over the years have been broadly classified into the categories outlined in the following table. These figures are as provided by the NERDC. Attempts to reconcile these figures with the annual plan commentaries and verification have been difficult and the figures are therefore accepted as reflecting a correct picture.

Output Category	2009	2010	2011	2012	Total
1. Products/Technologies Developed	3	7	9	5	24
2. Technologies Transferred to Industry/Entrepreneurs	4	0	6	9	19
3. Information Dissemination/Extension					
a. Publications	2	2	0	3	7
b. Events	80	69	37	32	218
4. Publications (Research Reports/papers)	6	3	2	4	15
5. Patents	0	0	1	0	1
6. Services (Testing, Calibrations, Consultations, Advisory etc.)	Substantial number of services are undertaken and difficult to quantify				
7. Training (Stakeholders)	14	12	15	27	68

Technologies Developed and Transferred

For an institute such as the NERDC, the primary output has to be the 'Technologies Developed' and even more importantly 'Technologies Transferred'. At first glance, based on numbers the figures of 24 and 19 over the four years appear respectable, but a closer examination reveals that the significance and impact of these on the national economy is at best marginal, even if they are adopted widely in the country, which unfortunately is not the case.

An exception to this is the Civil Engineering Low Cost Construction technology, which the Centre has worked hard to popularise with quite some degree of success. Even here an issue that surfaced is that some of the low cost construction technologies do not comply with the available standards (eg: British Standards used widely in Sri Lanka), and therefore the use of these technologies is not acceptable for large scale contracts. In some cases the required standard does not in fact exist, and in such cases the Centre should take the initiative to show that their products do comply with acceptable International Standards or collaborate with the Sri Lanka Standards Institute to develop new standards for these, in order to make these outputs widely adopted. This issue is very important and needs to be addressed.

The Technologies listed as transferred in 2009 and 2011 illustrate this:

2009	2011
Segmented type coconut oil extracting machine	Industrial Stove
Solar hot box	Pre-stressed yard construction
Wood gas stove	Cost-effective building / concrete door & window frames
Pre-stressed yard construction	Biogas technology
	Crematorium technology

A more careful analysis is required to establish the reason for the actual outputs in these categories to be so low compared to the activities undertaken, and leads to the question whether it is optimal to undertake such a large number of small projects, as opposed to working on a small number of large projects, that directly address key stakeholder issues. Clearly the Centre can benefit from developing a phased programmatic approach to its activities with clear milestones as opposed to working on isolated ad-hoc projects frequently initiated by the researcher concerned, or at best at the suggestion of a key stakeholder.

An issue to highlight is that the Centre, as in many of our R&D institutions, seem to have a tendency in general to work on Centre-initiated (in fact a majority individual-initiated) projects, develop technologies and work hard on popularising technologies to promote adoption (PUSH or supply oriented), as opposed to identifying projects in consultation with stakeholders, work collaboratively with them and ensure faster adoption (PULL or demand oriented).

Another is that quite a number of projects, while appearing to be complete per se and reported as such tend to have a degree of incompleteness in terms of the finalisation of the work and readiness and robustness to be adopted by the industry; the last 10% of the work, so to say. The stakeholder input at the stakeholder meeting also highlighted this as an issue.

The examples in the box below illustrate some of these aspects.

Stakeholder consultation and relevance of outputs: some examples

It is perhaps pertinent to use some of the recent projects carried out to highlight this issue. In the case of the Foot Bridge that was developed, after completion of the first prototype, NERDC found that the villagers prefer to have a wider bridge where three-wheelers also can cross. Provincial Councils are not accepting the technology quite readily; they too prefer a wider bridge. In the case of the tea dryer even after the second stage of development work where some of the problems of the first stage were eliminated, the adoption or the lack of it remains a serious issue. In the case of the flood water barrier it is even questionable who the real stakeholders are and the path to be adopted for the promotion of the technology is unclear. In the case of the bakery oven using biomass fuel, second stage development work continues, with inadequate involvement of the stakeholders.

These examples illustrate the inadequate stakeholder consultation, leading to shortfalls in needs identification, and estimation of adoption potential at the project planning stage.

This is of course not to say that there are instances of successful adoption such as the low cost construction technologies, but this is more the exception rather than the norm.

Information Dissemination/Extension and Patents

Clearly the Centre is quite active in this area and its participation in exhibitions and information dissemination through leaflets and other communication tools is quite good, but the issue could be the robustness and readiness of the technologies that are being promoted, as highlighted earlier. In terms of communicating with rural target audiences it may be possible to use other established government channels such as the Vidatha Centers, Nana Salas, Provincial Secretariats and Grama Niladharis, notwithstanding the fact that some of today's exhibitions are in the rural areas.

In terms of reviewed publications the Centre is quite weak, although there is a drive now to promote proper documentation on all projects as well as publications in research journals. An incentive scheme operates for this purpose.

The approach towards patenting is however quite neutral and not promoted, with a number of arguments as to the pros and cons of it being on the table. It clearly had a different culture in the past, with about 28 patents to its credit up to about 2007, with a dramatic drop evident afterwards. Patenting is not only a protective mechanism for the organisation's intellectual property but also is illustrative of its outputs.

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

Substantial numbers of services are undertaken in a range of areas; consultancy services for electrical installations, control systems, battery and LED importers, energy auditing, renewable energy, cost-effective building technology, LED or LCD lamp testing, are some. Stakeholder's view is that there are issues with respect to the delivery timing of the services, largely due to resource issues, although the general approach in providing the services are good.

It is the Panel's view that there is room to formalise and restructure these activities to develop an income generation arm for the Centre based on these services. The Centre also undertakes the construction/fabrication of civil/mechanical work, and the merits of this are questionable, as mostly there is no R&D element in the activity. While some good work has been carried out in this area, and it is accepted that this is very useful as a mechanism for popularization of own R&D outputs at the beginning, there is no reason for the NERD Centre to undertake such activities on a prolonged basis. Such activities should be transferred and carried out at well established approved state or private sector external workshops.

5. Findings and Recommendations

As was the case with most public sector institutions, the NERD Centre had operated under serious constraints of staff numbers over the period under consideration, mainly due to restructuring needs dictated by the Salaries and Cadres Commission. It was only in 2012 that the Centre could go ahead with recruitment after a period, somewhat easing the pressure. This, coupled with other difficulties in attracting engineers for recruitment, mainly inadequate remuneration levels for engineers, even compared to other public sector engineers and university lecturers, has eroded the HR base in terms of quality too, with only one M.Phil qualified engineer remaining in the Centre, with no Ph.D.s in 2012. Funds, although somewhat low in allocations, had not been the limiting constraint in general. The Centre is otherwise well endowed with space and equipment for its operations. The performance of the Centre therefore has to be viewed in this context.

Over the years, the Centre has generated a considerable amount of outputs in terms of technologies developed and transferred, but the effective widespread adoption of most of these is questionable, apart from a few projects such as the civil construction technologies. As a general conclusion, it is very difficult to say that the Centre has well fulfilled its obligations in terms of its Mission and the Mandate; more needs to be delivered.

The following are key findings and recommendations from our review, structured according to key operational elements relevant for an institute of this nature. It is to be noted that the focus in this chapter is largely on areas of improvement, and perhaps give a tone of an unbalanced presentation, but the reader is cautioned to look at in context.

I. Strategic and Corporate Planning

- The Chairman and the Director General are quite involved in the process of Corporate Plan development, but the indication is that the level and input of direction setting and strategic thinking into the Plan development process by the Board as a whole can be better. More focussed strategic Board input at the beginning, along with some discussion, brainstorming and feedback from different stakeholders can prove to be useful. Mechanisms for obtaining formal stakeholder consultation and input, both internal and external, must be developed and used in the Plan development process.

- More emphasis should be placed to strategically address staff issues: attracting, recruiting, training and retaining key R&D staff is a prerequisite for the performance and development of the Centre. While it is accepted that the public sector rules and regulations set the boundaries, particularly on the very important issue of remuneration levels, innovative approaches can be developed to improve this as well as adopt other strategic approaches to make the Centre more attractive to the young engineering graduates, as well as its own staff.

- The adoption of an improved research planning process, with more emphasis on using a programmatic approach, is necessary. Careful prioritisation and planning of research "Programmes" that address specific national goals/issues and focussed attention on the execution of such programmes will yield better results. The involvement of the BoG at a strategic level is important for this exercise. More emphasis is also necessary in ensuring that the Mandate/Goals/Objectives and Activities are well aligned.

- Considering a possible separation of 'Services' and 'R&D' with the 'Services' arm operating as an income generation unit, is an issues that merit attention at the level of strategic planning .

- Similarly a strategic, structured approach to developing international collaborations and partnerships must be discussed and developed. This is a necessary activity for the Centre to develop its staff and stay abreast with global developments.

- A formal and a well structured approach should be adopted to develop the corporate plan on a rolling basis. While the participation and ownership of the Centre staff should be retained, facilitation by a professional external resource person may help in the first instance. It is also useful to train some internal key personnel on strategic planning.

- To alleviate many of the deficiencies in Programme Management highlighted across this report, the need to centralise the coordination and monitoring of all programme/projects through the establishment of a Programme Management Unit (PMU) is an option the Centre should consider in their strategic and corporate planning exercises.

II. Programme Planning, Project Identification, and Implementation

- It is necessary to develop a program orientation in R&D planning as opposed to a project orientation, where the tendency is to undertake ad-hoc disconnected projects. Programmes must necessarily meet national needs and the mandate. Projects must be identified based on the criteria that they fit into each programme and upon completion that they will collectively achieve the objectives set in the "Programme".

- Rather than depend on individual initiated projects, directed idea generation to fit into strategically decided programmes is necessary. A strong emphasis on formal stakeholder involvement and TMD feedback is necessary in designing projects.

- The general practice of developing Centre initiated projects and PUSHING it later to the end user must be avoided as far as possible. Ensuring stakeholder involvement from the initiation of projects, and even working on the projects collaboratively with them will help generate a PULL on the projects and enable effective transfer and commercialisation.

- In general, significant results can be achieved by working on a few large size, multidisciplinary projects fitting into the programmes, rather than spend resources on a large number of small projects. An environment must be developed of forming teams from amongst the relevant Departments, and working collaboratively with other stakeholders such as industry experts, academia and stakeholders.

- Provision of formal training to the staff in R&D projects formulation, planning and management, and writing project proposals would be useful. Detailed documentation such as guidelines on filling project proposals need to be developed.

- Project proposals should have provisions to accommodate improvements and changes requested by the licensees after licensing a product through TMD. The project should not be closed at the time of handing over to the TMD.

- The rigour with which the R&D process is managed can be improved. The completeness of proposals presented to the Research Planning Committee (RPC), critical review by the RPC, and the criteria used and the approval standards set by the RPC need to be tighter and require improvement.

- The membership of the RPC which is constituted only of internal staff members is neither quite correct nor suitable. It is suggested that external stakeholders, particularly researchers, industry experts, and some Board members are included in the membership.

- The RPC meeting at the moment is open to all staff. This is not necessary and is non-ideal. It should be a closed one so that a proposal could be adequately questioned and scrutinised in detail.

III. Technology Marketing, Transfer and Extension Services

- Primarily the effectiveness of the technology transfer process depends on the needs of the market and the quality of the product/technology that is developed. Apart from a few stakeholder suggested projects, the present project planning approach does not lend itself to clearly identify the stakeholder needs and this process needs to be improved; this has been elaborated in the section above.

- Secondarily it depends on the transfer process itself, as administered by mainly the Technology Marketing Department (TMD) at the NERD Centre. The following recommendations are aimed towards improving the transfer process.

  - The communication between the R&D Departments and the TMD is somewhat linear, both in transferring projects and in receiving feedback. While retaining some of the formalities necessary for quality assurance, more frequent, and direct communication, and at times even informal, will improve the effectiveness of the technology transfer process. Seamless communications throughout the project life on a continuing basis must be established and encouraged.

  - While the TMD has a competent staff, strengthening it with a marketing outlook, with a more vigourous outward oriented proactive approach to exploit the R&D outputs will yield better results. The present predominant approach of newspaper advertisements calling for expressions of interest to use the products and technologies for commercialisation is somewhat limiting.

  - In addition to the TMD interaction with the customers, it is good to evolve methodologies for closer direct interaction of Centre R&D staff with customers during the initial transfer process, and the inception phase of the operation. This will have to be determined on a case by case basis, but an example would be the secondment of Centre staff for short periods with the customer. Follow up on transferred outputs by the TMD also need to improve.

  - It also appeared that the current licensing fee structure can be reviewed as the general basis appeared to be somewhat ambiguous. The corporate thinking of the Centre whether its outputs are provided to the end user as a public good either free or with a nominal charge, or whether it will charge a meaningful sum at least as a cost recovery mechanism has to be established. This clarity is required for a consistent approach in determining licensing fees.

  - The Centre should also think of strengthening the TMD not merely to transfer the R&D output to the customer, but converting it to providing a range of support services to the entrepreneurs/SMEs such as facilitation of funds, and also providing business consultancy. In other words converting it to an innovation centre.

  - After the technologies are transferred to licensees, the state of the licences should be assessed periodically by the TMD and the findings should be disseminated to the management as well as to the project group to take appropriate actions.

IV. Human Resource Management

- Currently most of the HR functions including attendance, leave and over time management are manually handled incurring much resources. Substitution of present system with an Integrated Human Resources Management system at the HR Department will ensure efficient and effective service delivery with a less recurrent cost.

- It is essential to strategically address staff issues in terms of attracting, recruiting, training and retaining key R&D staff. The current remuneration levels do not compare at all well with what the Engineers can demand in the market, nor even with the public sector. Correcting this however is not an easy task given the government systems that are in place now, but all attempt must be made to develop approaches, even non-conventional, to overcome this situation. On the other hand, the available reward systems are unattractive as well as underutilized. Therefore attractive and equitable financial reward/incentive systems should also be developed and introduced. It is stressed that unless a solution is found for this issue of remuneration, the long term sustainability of the Centre is clearly at risk.

- The needs of knowledge workers such as the R&D staff at NERDC are not only salaries but also *higher level needs such as respect, autonomy, achievement, status, recognition and attention (Robbins, 2004).* Unlike in the private sector, none of these measures unfortunately can be easily applied to state sector organizations due to a myriad of restrictions and regulations. It is very difficult to address this issue but the leadership could be mindful of these needs and work towards developing this culture even within a very difficult environment.

- There is an acute need for Ph.D. level training among the R&D staff. Therefore more emphasis should be placed to explore and provide more postgraduate level opportunities by the HR Department and the research staff should also be encouraged to explore suitable opportunities.

- The requirements for absorption or promotion to higher level research grades need to be reviewed to aim for a mix of Chartered Engineers and personnel with higher research degrees at the higher grades.

- Strong emphasis should also be placed on staff development in collaboration with international institutions. This enables exposing and training of Centre staff using international Centres; a necessary tool to be adopted to ensure that the staff is well abreast of modern technologies and research methods.

- The general consensus among the NERDC staff is that the lower grade categories are overstaffed. Lower grade employees are of the opinion that they are redundant due to inadequacy R&D staff to utilize them optimally. Therefore right sizing of staff through proper manpower planning and recruitment is required.

- NERDC as a research centre should be prepared to cater to the needs of national development for which there should be a dynamic environment where a comprehensive programme is in operation. This can be realized only under a situational leadership that chart the path for inculcating a team culture among R&D staff at different levels and among diverse staff categories. Thus NERDC needs to pay attention towards a strengthened research leadership.

- Performance appraisal system at the NERDC is neither linked to gap identification nor career advancement of the staff. Therefore an appraisal system that provides every individual to involve

in goal setting, regular progress monitoring, identifying gaps and directing for career advancement should be introduced.

V. Documentation, Knowledge Management and Management Information System

- NERDC operates an effective financial information management system where every research staff member can obtain the financial information about each project. One clerical staff member in each Department is given access to the information system. However it would be prudent if access is given to all the research staff through their own computer as everyone has a computer connected to the network.

- A good comprehensive database and a documentation system need to be established on the research projects, their progress and status, and outputs. The impacts or benefits arising from the projects also can be included in this database. This will not only help manage research better, but will also develop into a useful compendium as a corporate marketing tool.

VI. Communication and Information Dissemination

- The modes of information dissemination should be expanded to reach the national and international stakeholders, in order to justify the government's investment on the Centre, and also to attract collaborative activities with other organizations. The main method of dissemination of research findings should be through publishing in learned journals and national and international conferences. The Centre should aim at publishing a minimum number of research papers annually in recognized journals or Conferences, and holding a National/International Conference for dissemination of findings once in two years or so.

- The Centre can also make use of its website to its advantage by making it more interactive and user friendly, by introducing social networking media such as blogs and forums, to disseminate information, get customer feedback, provide advice to the users of the NERDC technologies etc.

- In the case of popularising technologies amongst rural target audiences' use of existing government channels such as the Vidatha Centres, Nana Salas, or the Provincial Secretariats and Grama Niladharis may be an option.

- The management should provide funding and technical support for enhancement of the electronic communication facilities, as this is a way of overcoming some of the disadvantages of its location, with poor access by public transport. Wide use of teleconferencing / video conferencing / Skype would help the communication with other research institutes and universities very convenient and the staff will be motivated to be on par with the rest of the world.

- The internal communication among the various Departments of the Centre has to be improved, so that the projects and programmes can be carried out seamlessly. Multidisciplinary teams should be encouraged.

VII. Organisational Assets

- Knowledge Assets: Limited scope of current R&D programme has undermined the status of the NERDC as a pioneering research establishment. Therefore the NERDC should review and improve the research plan for next five years with the participation and consultation of all stakeholders in order to ensure that it covers the institutional mandate in its entirety. Research and development should be prioritized in this review process. Knowledge loss through turnover

of staff can be considerable and does affect the progress of the projects. A strong, well designed knowledge management/ documentation process therefore is a prerequisite.

The final project reports collected and preserved in the NERDC library, is a simple record of what has been done and the outputs. The final report structure must be improved to include more scientific content including the research methodologies adopted and other detailed information such as how the project was formulated, resource analysis and financial details, and even the technology transfer package. This will be beneficial to future researchers and will enable them to formulate continuation of projects.

- Staff: Frequent loss of talent has threatened the reputation of the organization. Introducing incentive schemes and more facilities are essential as measures for improving the quality of outputs/outcomes and protecting intellectual properties that build and maintain the reputation of the organization.
- Physical Assets: The maintenance of the premises, plant and equipment is good.

Appendix 1: Management Assessment

I. Assessment of institutional response to external and internal environment in planning organizational strategies

Management practice	Level of practice (Performance Indicators)			Comments/Evidence
	Strong	Moderate	Weak	
Government policies and development goals are used /considered to establish goals and plan organizational strategy	x			Government and S&T Policies are taken note of in establishing goals. The Chairman and DG who attend regular meetings at the Ministry give the input to the organisation for incorporating the policy perspectives
Organizational mandate (as specified by the relevant act) is considered in strategic planning		x		Corporate plan development is not a very formal process, although rolling plans are developed every year. Mandate is addressed, but not quite in depth.
The institution is responsive to changes in government policies and strategies	x			The Centre is very responsive to directions provided by the Ministry. Expansion of Testing Services is in line with the needs arising from Government strategies.
Factors such as strengths, weaknesses, threats and opportunities are considered in strategic planning			x	An in-depth and structured analysis of the SWOTs and their impact in strategic planning is not evident, although these factors are included in the corporate plan.
Stakeholder needs are taken in to consideration in strategic planning			x	Annual Corporate Plan is developed internally and no stakeholder consultation takes place.
The Board of Governors is involved in strategic planning		x		The Board of Governors is not adequately involved from the beginning although they review the plan and approve it, but the Chairman and the DG are quite closely involved.
The extent to which staff members are involved in strategic planning			x	Mainly Heads of Departments are involved, and not the general staff.
Government allocations and alternative funding opportunities (donor funding) are considered in strategic planning		x		Mainly government grants are considered, but no other funding opportunities are explored nor taken into account.
The extent to which policies and plans of the organization are reviewed and updated		x		The annual rolling plan appear to be a quick refresh of the previous one, as opposed to a fully reviewed and updated document.

II. Planning S&T programs and setting priorities

Management practice	Level of practice (Performance Indicators)			Comments/Evidence
	Strong	Mode rate	Weak	
National development goals are considered in planning programs & setting priorities			X	Corporate plans 2009-2011 or the projects conducted by NERDC do not show evidence that national development goals were considered in planning. Though requests made by ministries were often considered, the relevance to these projects to the national goals is not always clear. 2013-2015 corporate plan state that the national development goals will be considered in planning.
Board of Governors participate in planning and priority setting of program			X	Only Chairman and Director General represent the Board of Governors
The extent to which the staff of the institution participate in program planning and priority setting			X	Staff as a team does not participate in planning programs or setting priorities. Projects are selected primarily on personal interest or if it is requested by an outside institution while providing funds. The relevance to national development is used to justify the projects, but project selection is not governed by the national development goals.
Stakeholder interests are considered in program planning			X	Stake holders are not involved in project planning. When companies request for a work, NERDC carryout charging a fee
The extent to which programs are planned and approved through appropriate procedures		X		Individual member plan projects and then approve at the RPC. There is predefined project proposal format is available. However it was observed that the sections in the report are not completed adequately. Inadequately completed reports are approved by the RPC without scrutinizing the proposal. For example one research proposal note that related work done by other institution is not yet studied but the proposal was approved by the RPC.
The obtaining of necessary equipment is considered in planning programs		X		The laboratories are well equipped. Project proposal format has provision to describe the equipment required.
Stakeholders are represented in the institutions planning & review committees			X	Stakeholders are not represented. TMD, who is knowledgeable about stakeholders' requirements, is not involved at the planning or reviewing stage. There is no evidence of doing reviews after technology is transferred. Then the feedback is sent to the Department concerned through official channel. However there is no evidence to show that constructive dialogue

				between the stakeholders and the Departments happens after completing the projects.
The extent to which socio economic and commercialization aspects are considered in program planning			X	The proposal format requires to state benefits of the project but does not specifically request commercialization aspects. NASTEC review panels considered this as an important aspect that NERDC would be looked into.
Effectiveness and efficiency of institutional procedures in approving new S&T programs.		X		There are good feedbacks given at the RPC when approving projects. However, it seems that all projects submitted to RPC had been approved. For example one project was done to find out the actual cost of building a low cost house.

III. Planning S& T / R& D Projects

Management practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
The staff is provided with guidance for project planning			X	We did not find evidence that staff is following project planning methodologies. We could not find evidence to show that staff has been trained in project planning.
Previous research results/data are used for planning projects		X		There are projects conducted to improve their previous projects. During the planning stage the deficiencies of the previous products/research had been considered. However, the reports do not show evidence to show that the results/data are used in planning stage. For example, low cost building project is being carried out after transferring the technology to many licensees. However adhering to a standard or establishing a new standard is not yet considered though lack of standard has been identified as a major obstacle for popularizing the technology.
The extent to which the institution follows a formal process for preparation, review and approval of projects		X		Formally, a project proposal is submitted to RPC for approval. However the example proposal presented to review panel shows that, the report is not completed with sufficient information to make an informed judgment. The RPC minutes shows that all projects are approved. The RPC meeting is not a closed discussion. Presence of the staff members who are not involved in the project is not suitable for a critical analysis and discussion.
The extent to which organizational plans (e.g. medium-term plan, corporate plan, strategy etc.) are used to guide project selection and planning			X	Projects are selected primarily based on personal interest of researcher/s. Though the proposals indicate the relationship to national development, the projects are not linked to corporate plans or strategy.
Multidisciplinary projects/ activities are encouraged by the institutions		X		Usually projects are initiated by a single researcher or couple of researches in one Department. This is primarily because the projects are initiated by the Departments. However, it was observed that occasionally researches from other Departments are get involved at some stages of a project.
Foreign collaborations are encouraged and incorporated in planning.			X	We could not find any foreign collaborative project. We are of the view that foreign collaborations are generally overlooked at the planning stage though there could be ample opportunities.
Partnership with private sector is encouraged by the institution		X		Collaborative researches conducted with universities are hardly found except for couple of projects where researchers are registered for postgraduate programs.

The extent to which development research/activities are considered in planning projects			X	No evidence found to show that detailed analysis has been done to indentify the research/development activities needed for a given project. The example proposal shows that the proposal was approved without investigating the related projects conducted by other institutions
The extent to which basic research are considered when planning projects			X	All the research projects are applied research projects.
The degree to which adverse effects on environment are considered in planning projects		X		There are several projects, such as waste disposal, are done on mitigating adverse effects on environment. Some other projects do not have environmental effects caused by the project itself. Benefits to the environment e.g. reduction of GHG etc. are considered for justifying projects. However, there is no evidence to show that the effects on environment have been considered in detail during the planning stage. The project planning sheet does not require environment impact assessment.

IV. Project management and maintenance of quality

Management Practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
The effectiveness of the procedures for resource allocation at difference levels (Organization, Department, program etc.)			×	There are no procedures for resource allocations at different levels, when preparing Project Programmes.
Ensuring that instruments, equipment and infrastructure facilities are sufficient for implementation of Projects.		×		It was observed that equipment are available for testing purposes, but during the stakeholders' meeting, it was stated that there were delays to obtain the services from the NERD. Therefore, question is the adequacy of the available instruments, equipment, infrastructure facilities and human resources to meet the requirements.
The effectiveness of Administrative Procedure and support for Project implementation (procurement and distribution of equipment and materials, transport arrangements, etc.)		×		Procedures used to monitor financial status and procurement activities are effective, but it was observed that the officers, who are handling the projects, do not effectively use the available data when implementing and monitoring Projects.
Formal monitoring and review processes are used to direct projects towards achievement of objectives.		×		During the Project Proposal stage, Research Engineers prepare programmes (activity schedules), but evidence were not available to show that they use activity schedules to monitor and review processes to achieve project goals.
The extent to which the researches are supported by the required technical/ field staff.		×		No complaints regarding the non availability of Technical/ Support staff. But, there are a number of vacancies in Researchers' carder.
Ensuring that established field/ lab methods and appropriate protocols are used.	×			Yes. At the stakeholders' meeting, it was observed that they (public) have trust and confidence on field/ lab methods and procedures used by the NERD.
Research Projects/ R & D activities are completed within the planned time frame.			×	Reviewing the self assessment reports and also discussing with Researchers, it was observed that only a few Projects completed meeting the planned time frames.
Ensuring that Scientists/ Researchers have access to adequate scientific information (Scientific journals, internet, international databases, advanced research institutes, universities etc.) that strengthens the quality of research.		×		Library and Internet facilities are available and no complaints relating to non availability of the required scientific information.
The extent to which quality assurance practices are followed by the Institutions.			×	No quality control section and also no established procedures/methods to control quality of the services provide by the NERD.
Ensuring that Researchers/ Scientists have access to computers and necessary software.	×			Yes. Adequate facilities are available.

V. Human Resource Management

Management Practice	Level of Practice (Performance Indicators)			Comments/Evidence
	Strong	Moderate	Weak	
The institute maintains and updates staff information in a database (including bio data, disciplines, experience, publications, projects)		X		Staff records are maintained separately for JM, MA and PL staff in a filing system with a computerized database for some staff records, but not regularly updated.
The institution, plans and updates its staff recruitments based on programme and project needs			X	Top management involve in manpower planning complying with the SOR and based on the institutional needs but not on regular basis. Both over staffing and under staffing are characteristic to the NERDC.
The effectiveness of the selection procedures and the schemes of recruitment		X		Recruitment and selection follows the SOR though it has both pros and cons. It maintains uniformity and ensures transparency but the procedure is long and complex and has constrained fulfilling specific staff requirements and failed to retain talents due to comparatively low salaries.
Training is based on institution and programme objectives and on merit			X	Training opportunities decreasing over time, NERDC has a severe shortage of trained staff at post graduate level, no extra efforts to explore additional training opportunities, a must for a knowledge organization.
The effectiveness of the procedures in promoting a good working environment and maintain high staff morale			X	The location of NERDC restricts easy access by internal and external customers. Travelling facilities has become an incentive for retaining R&D staff. Dissatisfaction prevails due to inadequate assistance from supporting staff, huge gap of relations among the R&D staff resulting poor guidance for new comers.
The effectiveness of staff performance appraisals			X	Annual performance appraisal is a simple process by immediate supervisor without the knowledge of employee having room for subjective evaluation. Neither actual performances are evaluated nor linked with gap identification and career advancement.
The effectiveness of rewards and incentive schemes in motivating the staff			X	Reward systems are in place but unattractive as well as underutilized.
The effectiveness of managing staff turnover, absenteeism and work interruptions			X	S&T staff has a high turnover rate of 22% which is detrimental as they take out critical knowledge. Turnover among research engineers is largely due to low salary levels and poor working conditions. No proper retention plan at the moment. Absenteeism and work interruptions are not serious issues.

VI. Management of Organisational Assets

Management Practice	Level of Practice (Performance Indicators)			Comments/Evidence
	Strong	Moderate	Weak	
The ability of the Institute to carry out its mandate and the assigned statutory powers		X		Though NERDC is equipped with funds, infrastructure, vehicles and equipment poor strength of R&D staff coupled with limited scope of the current work plan has failed to cover the institutional mandate in its entirety.
Infrastructure (buildings, stations, fields, roads) is satisfactorily maintained	X			Adequate inputs and processes are in place at the NERDC for maintenance of infrastructure satisfactorily. Further improvement in physical outlook of the centre may contribute to increase satisfaction of customers both internal and external.
Vehicle and equipment (lab, field, office) are properly managed and maintained	X			Management and maintenance of vehicles and equipment at the NERDC is of high quality and continues without constraints under the responsibility of the maintenance unit.
The effectiveness of procedures to ensure that equipment are in working order	X			The preventive maintenance system which follows periodic monitoring of functionality of equipment ensures proper functioning of machines and equipment.
The effectiveness of the institute's overall strategy in generation and proper utilization of funds		X		As evident there are no funding restrictions and fund utilization too remains at a higher level amounting to an average of 86% of the allocation for the last three years. The fact that how effective is the fund utilization is a matter of appropriateness and adoption of technology which requires in-depth studies to assess.
The extent to which the institution identifies opportunities for income generation and cost recovery		X		At the moment NERDC satisfies with an effort for income generation amounting to 15% of the total budget particularly through consultancy and professional testing services. Any future directions of NERDC for income generation and cost recovery should not substitute the R&D rather than to complement the same.
The extent to which the intellectual property rights of the institute are protected		X		The institute has managed to protect its intellectual property rights effectively however the inability to retain staff and the consequent staff loss frequently results in knowledge loss as well.

VII. Coordinating and integrating the internal functions/activities

Management Practice	Level of Practice (Performance Indicators)			Comments/Evidence
	Strong	Moderate	Weak	
The extent to which institution is evaluated internally and restructured based on current needs		X		There is no evidence to show any internal evaluation, needs assessment or restructuring. However, planning meetings and staff meetings are held regularly (meeting with DG)
The effectiveness of internal communication and coordination mechanisms			X	The individual Departments are working in isolation; no formal networking or two-way inter-departmental coordination; TMD feedback is not much helpful to the Departments for product improvement as the project is normally closed at time of handing over to TMD and any substantial improvements have to be formulated as a new project; budgeting and accounting information not used by Departments for self-monitoring; monitoring is done centrally by DG. There is also poor inter-relationships among the employee groups –such as engineers and technical staff (discussions with TU's)
Institution's overall direction and coordination are provided by a central planning committee/ unit		X		However, the research direction is not based on sound needs assessment, and mostly depends on the individual preferences. (inferred from discussions with various groups); Direct comment by the CMU representative – "there is lack of leadership in the organisation leading to poor direction of engineers to do research"
The extent to which different units are assigned clearly defined functions		X		The roles seem to be adequately defined, but due to the poor communication among the entities and other reasons, there appears to be avoidable duplication – e.g. construction activities by mechanical eng. staff, workshops in Departments in addition to the Central workshop.
Responsibilities of research / management staff clearly identified			X	The research staff are being used to do routine work (electrical dept) and implementation of projects (civil eng) rather than conduct research. There is little guidance on research for the junior staff, and there are no senior staff with any PhD or MPhil qualifications in most departments, and hardly any external inputs from qualified researchers.
Effectiveness of using appropriate reporting procedures and feedback in management at different levels		X		Some reporting system is available. However, the research proposal forms and research reports submitted on completion do not appear to be reviewed seriously, as seen from the sample of accepted documents produced for the team's observation.

VIII. Partnership in managing – Information dissemination

Management Practice	**Level of Practice (Performance Indicators)**			**Comments/ Evidence**
	Strong	Moderate	Weak	
The institution ***systematically plans*** and performs dissemination of information			X	Publication of research findings is not regarded as a responsibility by the engineers, although the DG states that the research allowance is available, and there is an incentive payment for authours of published research. Newsletters are published sporadically.
The extent to which the institution ***plans and maintains linkages*** with key partners for sharing and dissemination of information			X	There is no formal linkages with other relevant govt. Organizations like SLSEA, Universities, ITI etc. –perhaps reluctance due to possessiveness (meeting with board members)
The ***effectiveness*** of institutional ***procedures for technology transfer***		X		TMD is responsible for technology transfer. Records are kept up to date. Website is available. Procedures are laid down, but implementation is weak, there are no officers qualified in marketing
The effectiveness of the system to obtain feedback from different types of stakeholders			X	No stakeholder meetings are held. The stakeholders we met had many constructive suggestions which could have been used to the benefit of the organization. Feedback for product improvement obtained by TMD from the users does not get back into the project cycle effectively

IX. Monitoring, evaluation and reporting procedures

Management Practice	Level of Practice (Performance Indicators)			Comments/Evidence
	Strong	Moderate	Weak	
The Institute monitors and evaluates (M & E) its own activities periodically.			×	Other than the annual self-assessment report and minutes of the head of the Departments' meetings, no other evidence was found in this regard.
M & E is supported by an adequate Management Information system (MIS), which includes information on projects (e.g. costs, staff, progress and result)			×	Financial reports are available to show allocations/ expenditures relating to individual Projects and other than that no effective Management Information System is available.
The extent to which R & D results and other outputs are adequately reported internally (e.g. through reports, internal programme reviews, seminars)		×		Each and every Project, there is a Project Report prepared by the Researcher. But, it is necessary to improve the quality of the report. For examples, Targets vs. Achievement. Resources used, lessons learned etc.)
External stakeholders contribute to the M & E process in the institution.		×		There were evidence that external stakeholders contribute to the M & E projects (Development of machines for Ayurvedic Sector, Biomass etc.).
The extent to which the results of M & E are used for the Project / Research Planning and decision making.			×	Very poor. There are no evidence to show that the results of the previous Projects were used in the planning and decision making.

Appendix 2: The Terms of Reference of the Review Panel

National Science and Technology Commission

External Review of the National Engineering Research and Development Centre

Terms of Reference

Objectives

The Science and Technology Development Act No. 11 of 1994 mandates the National Science and Technology Commission, *inter alia*, to review the progress of science and technology institutions in relation to the Objects set out in section 2 of the Act (see Appendix)

Accordingly, this review is carried out with the Objective of determining the progress of the National Engineering Research and Development Centre in achieving such of these Objects as are relevant to it, to assess the quality, cost effectiveness, relevance, and impact, of the scientific programmes conducted at the Centre, and to ensure that the needs and expectations of the government and other stakeholders are being met to the fullest extent possible.

The review may also serve

- To obtain information on how to improve the activities of the Institution
- To induce self-reflection by the scientists at the Institution on the results and outcomes of S&T activities
- To encourage good management of the Institution
- To improve internal and external transparency
- To recommend future resource commitments
- To gather information for policy change
- To inform stakeholders about the Institute's competencies.

Duties of members of the Review Team

Members of the review team are expected to follow the procedures described in the Review Manual prepared by NASTEC. This includes:

1. Study of the self-assessment report submitted by the Institute (NERDC). NASTEC will provide you with a copy of this report. While the review is based on the information contained in this report, it need not be confined to the report.
2. Site visit to the Institute after preliminary discussions with the Director of NERDC. You may have to examine previously requested documents, and interview relevant officers, in order to gather information necessary to evaluate the institution. Transport will be provided by NASTEC.
3. Meeting with stakeholders of the Institute, in order to determine whether their expectations are being reasonably met by the Institution. The meeting will be set up by NASTEC in consultation with the NERDC.

4. Preparation of the draft report and submission of the same to the Director, NERDC, for his comments.
5. Preparation of the final report and submission of the same to NASTEC. After the comments of the Director, NERDC, on factual matters of the draft report have been received and given due consideration, the Chair of the Review Team will be responsible for finalizing the report, in consultation with the other members of the ream. The final report will be circulated by NASTEC to all relevant parties.

The draft and final reports should contain assessments of both the management and output of the Institute, covering all areas included in the Review Manual to the extent that they are applicable, and submitted in the format described in page 29 of the Review Manual. The team may use its discretion in dealing with any additional matters not covered by the Review Manual, which in their opinion are relevant and important for purposes of this review. This should be done with proper documentation and justifications.

The member of the team should always bear in mind that, while the review report must address the needs of all concerned parties, such as policy makers, the relevant line Ministry, and the Treasury, its most critical function is to guide the Institution being reviewed towards self-improvement, at the institutional, project, and individual levels. It should be based on the Institution's mandate, and contain constructive criticisms, an unbiased analysis of the findings, and recommendations for improvement.

Appendix: Section 2 of Act No. 11

(a) to promote the use of science and technology as an integral part of the effort to achieve rapid economic development, and improved quality of life and to alleviate poverty, and to involve scientists and technologists in the formulation of policy and in decision making ;

(b) to foster scientific and technological activity in all its aspects with a view to developing self reliance in scientific and technological capability and to ensure the allocation of a reasonable proportion of the gross national product for science and technology activities;

(c) to support the development of indigenous technology wherever feasible whilst promoting the import, adaptation and assimilation of technology for rapid growth in industry agriculture and services;

(d) to ensure that institutions of higher education and technical education and research institutions produce scientists, technologists and technicians of high caliber and competence and to secure the provision of incentives to them with a view to ensuring their retention in Sri Lanka;

(e) to provide adequate opportunities for all persons to acquire a basic education in science and its practical applications:

(f) to cultivate among the people, an appreciation of the value of science, scientific method and technology and of the integral role that science plays in modern society;

(g) to disseminate the benefits of science and technology activity to all sectors of the people;

(h) to encourage and strengthen cooperation in science and technology between scientists in Sri Lanka, and between scientists in Sri Lanka and scientists outside Sri Lanka, and to provide access to global scientific and technological knowledge and activity ;

(i) to develop the capability to continuously plan, evaluate and review strategies, legislation: and the institutional framework for science and technology in Sri Lanka ;

(j) to identify priority areas of science and technology likely to be of benefit to Sri Lanka and to promote research and development in such areas.