

EXTERNAL REVIEW REPORT OF THE INSTITUTE OF POSTHARVEST TECHNOLOGY



AUGUST 2017

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2017

Signature of the review committee:

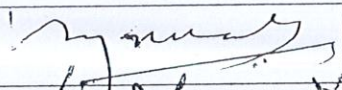

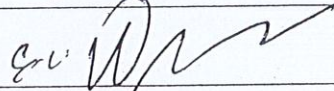
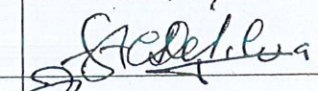
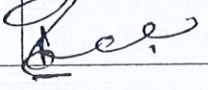
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EXTERNAL REVIEW REPORT OF THE INSTITUTE OF POSTHARVEST TECHNOLOGY

1. INTRODUCTION AND BACKGROUND

Established in 1987 as the apex body for agricultural research, the Sri Lanka Council for Agricultural Research Policy (SLCARP), under the Ministry of Agriculture has been mandated to review the institutes of the National Agricultural Research System (NARS) at regular intervals to assess their performance and suggest improvements.

As stated by SLCARP, there are several objectives of these external reviews:

- To assess the quality, cost effectiveness, relevance and impact of the scientific programs carried out by the institute to ensure that funds allocated are effectively utilized to address the sector needs.
- To assess the appropriateness of the research agenda of the institute to meet the emerging future challenges, particularly with the view of achieving Sustainable Development Goals (SDGs) (SDGs: Transforming our world: the 2030 agenda for sustainable development adopted by the UN General Assembly in September 2015) and the national targets for ensuring food and nutrition security.
- To examine all aspects of the research and development programs, extension, advisory consultancy and other services offered by the institute and their effectiveness, impact and timeliness to the stakeholders.
- To identify the deficiencies and shortcomings in the procedures adopted in recognizing the research needs of the sector by the institute and
- To provide advice and guidance on effective planning and implementing of future programs of the institute

1.1 The Review Team and the Review Process

As mentioned above the Council of the SLCARP at its 201st held on 28th March 2017 has appointed a team of five experts (listed in page v) to carry out an external review of the institute.

The Terms of Reference for this review (TOR) is given in Annex 1.

The Self-assessment Report prepared by Chief Mechanical/Chartered Engineer H.M.A.P. Ratnayake of the IPHT was used during the review of this institute.

The review was carried out during June – August, 2017. The review team visited the institute on two occasions and met the members of the governing board, and technical and non-technical staff of the institute, examined the relevant documents and inspected the facilities available during the review period. The report has been prepared in 13 Chapters each giving a brief description of the activity and the information has been analyzed to identify strengths, weaknesses, opportunities and threats and possible solutions for improvement have been stated. The review team has considered the significant achievements in the past in different

activities and those have been commended. Finally, a set of recommendations have been made for the improvement of this institute.

2. BRIEF HISTORY OF THE INSTITUTE

The Institute of Postharvest Technology (IPHT) is an institute located in the country's major agricultural area of the dry zone in Anuradhapura District in the North Central Province of Sri Lanka. It is listed under the Ministry of Agriculture and established on 19th June 2000 under Gazette Extraordinary No. 1137/10 of the Democratic Socialist Republic of Sri Lanka under the provisions of the State Agricultural Corporations Act No.11 of 1972. The purpose of the establishment of this institute was to undertake postharvest research and development activities to minimize losses in paddy and other cereals, grain legumes, oil seeds and other field crops, fruits, vegetables and spice crops and fruits, vegetables, ornamentals and in the training and extension, consultancy, advisory and other services for providing self-employment opportunities and to achieve food and nutrition security for the people of this country. IPHT has taken over the functions of the Rice Processing Research and Development Centre (RPRDC) of the Paddy Marketing Board which was set up under UNDP/FAO assistance in 1976. IPHT is mandated as a national institute for postharvest research and development and functions as a coordinating body for other similar agencies involved in postharvest technology research in the prioritization of research and development programs.

To facilitate services throughout the island, the IPHT has established an extensive network of 07 postharvest technology transfer centers located in major crop producing areas of the country. These are located at :i. Anuradhapura covering Anuradhapura, Polonnaruwa and Trincomalee, ,ii. Ambanpola covering Kurunegala, Puttalam and Gampaha, iii. Kandy. covering Kandy, Matale and Kegalle ,Mahiyangane, iv. Ampara covering Ampara, Moneragala and part of Batticaloa and Mahaweli System C, v. Nuwaraeliya covering Nuwaraeliya and Welimada, vi. Hambantota covering Hambantota, Galle, Matara and Embilipitiya and vii. Kilinochchi covering Kilinochchi, Vauniya, Mullative, Jaffna and Mannar. These centers are engaged in technology transfer activities and implementing the development projects initiated by the institute.

3. ORGANIZATION AND MANAGEMENT

3.1 Governance:

The IPHT has established a comprehensive system of governance under the guidance of the Ministry of Agriculture and the Board of Management of the institute. The Board of Management which is appointed by the Ministry of Agriculture consists of a Chairman, Deputy Chairman and 05 members (Annex 2). The Board meets regularly at monthly intervals to discuss policy issues and guides the Director, who is the Chief Executive of the institute regarding procedures for implementation of programs/projects including financial outlays. At the second tier of administration, there is an Executive Committee headed by the Director and Heads of Divisions. The implementation, monitoring and evaluation of projects and all other activities are under the control of the Executive Committee.

The manual of procedures, Administrative Regulations (A/R) and Financial Regulation (F/R) of the Government are available and freely accessible to all staff. The recruitment, promotions, dismissals and disciplinary issues are also according to the existing government rules and

regulations. All research staff and other administrative staff are kept informed regarding the activities of the institute through the website (www.ipht.lk) with free access to all staff.

The above are acceptable procedures used in good governance, however, Code of Ethics for all employees and Research Ethics for R&D staff of the institute are not available. A system to motivate and reward best practices with a feedback mechanism is also not available. In regard to this, recently some employees have received recognition for long service engagement. This and other means of recognizing the services of employees will motivate employee efficiency and build harmony among all staff of the institute.

3.2 Initiatives for strengthening good governance:

Currently (July 2017) the IPHT management had a proposed series of positive measures to strengthen its responsibilities. The changes have received the approval of the Board of Management. These changes are being introduced while the current review is in progress and some changes reflect the views of the Review team.

The commitment of the current management to improve the good governance and transparency is commendable. Following are main measures that had been approved by the Governing Board.

- a. Changes to the procedure of identifying and implementing of research projects: The amended procedure is documented in "Code of guidance on identification, implementation, and technology transfer of the research projects of IPHT, July 2017". Improvements had been made on areas of research selection / advisory committee, implementation and progress review and technology transfer. The code of guidance was first issued in 2011, a revision in 2016 and the current 2017 issue is with further improvements.
- b. Series of Committees to facilitate various management regimes: The Board of Management had institutionalized and committee chairmen appointed to five strategic committees. They are: i. Legal Affairs Committee ii. Administration Committee iii. Development Projects Committee iv. Income Development Committee v. Research Releasing Committee.
- c. Establishment of "International College of Postharvest Engineering and Technology" and appointment of a consultant to establish it is contemplated.

3.3 Vision and Mission of the IPHT

The IPHT has developed a forward looking Vision and a Mission to guide its future.

Vision: *To be a center of excellence in postharvest technology.*

Mission: *To enhance productivity and facilitate competition of the agribusiness sector through postharvest research and development.*

3.4 Objectives of the IPHT

IPHT has also developed seven (7) Objectives which cover all its R&D activities as listed below:

1. Prevent postharvest losses occurring in grains, other field crops, fruits, vegetables, spice crops and cut flowers by introducing improved cost effective technologies so that the incomes of the rural farming sector will be increased as a result of the increase in their

marketable surplus. At national level such measures would increase the quantity of essential food and other consumer items available for consumption in the future.

2. Prevent the deterioration of quality occurring in grains, other field crops, fruits, vegetables and spices due to adoption of improper postharvest handling, storage and processing techniques so that the quality of these essential food commodities reaching the market is significantly improved. Improvement of product quality will enable the farmers to sell their "value added" produce at an attractive price in the competitive market and thereby increase their incomes from agriculture.
3. Prevent the nutritional losses occurring in cereals, pulses and other food crops, fruits, vegetables and spice crops due to (adaptation (use) of improper postharvest techniques and thereby increase the nutritional status of the country.
4. Improve farm level storage and preservation facilities to enable the farmers to sell their commodities during off- seasons at attractive prices and thereby increase their incomes.
5. Introduce improved postharvest techniques that utilize minimum labour in order to reduce production cost of agricultural commodities.
6. Develop and transfer viable agro based industries at rural level in order to increase income and employment opportunities of the rural farming sector and thereby improve their standard of living.
7. Popularize the use of food prepared from grains, pulses, fruits, vegetables and spice crops among consumers in order to create a higher market demand for the local grain production. Increased consumption of these foods of high nutritional value will also lead to an improvement of the nutritional status of the country.

Although a Vision, Mission and Objectives have been stated, these are not well focused and precisely presented. For instance, the Vision statement is inadequately focused and does not indicate how the institute plans to make progress in the future years. The Mission statement is grossly inadequate and Objectives are vague. The Goals to be achieved are totally absent. Although several objectives will be required to achieve the mission of this institute, only one objective is significantly highlighted, ie, postharvest and nutrition loss prevention. The above statements of the institute should be revisited by the staff of the institute and the Govern body. The strategies for achieving the specified objectives and the Key Performance Indicators (KPIs) are also not stated.

The review team noted that the institute has developed a Corporate Plan up to 2015, after which it has been discontinued due to instructions of higher authorities. However, a time-bound Strategic Plan is important to guide the destiny of this organization, for future directions and allocation of resources for overall development of the institute.

Therefore, the review team considers important to develop a Strategic Plan which is the major instrument to achieve the Vision and Mission of this institute. This plan should include the major Goals, specific, measurable and realistic Objectives, and Strategies to achieve objectives, allocation of resources and key performance indicators (KPIs).

4. ORGANIZATION OF THE INSTITUTE

Previously the institute consisted of eight (08) divisions of which 05 were technical and the other 03 were non-technical administrative divisions. The technical divisions are:

1. Production/ Mechanical and Process Engineering Research,
2. Postharvest Handling Research (Durable crops),
3. Postharvest Handling Research (Perishable crops),
4. Product Development and
5. Technology Transfer.

The other three divisions included:

6. Administration,
7. Finance and
8. Internal Audit divisions.

In order to cater to the future requirements, the institute has re-organized its organizational structure in January 2017 and the following 10 divisions have been proposed.

4.1 Proposed New Divisions

1. **Research Division:** This division is the key division which is mandated to conduct research on trust areas namely; postharvest handling and loss prevention, Processing and value addition and Food Security and Human Nutrition. In the implementation of selected research programs this division where appropriate will collaborate with other scientific institutions of the country, universities and the private industry.
2. **Engineering Service Division:** This division is engaged in engineering research involving design, fabrication testing and evaluation of postharvest machinery and equipment in relation to cereals, other field crops, fruits, vegetables, and spices. It also conducts research on processing techniques such as freezing, refrigeration, drying/dehydration, fluidization, waste treatment, thermal processing and utilization of by-products. It also provides consultancy services in the design of production/processing plants, training on machine operations and maintenance and performance evaluation of agro-food processing machinery at commercial level. This division works closely with the Technology Transfer Division of the institute to transfer the potential and proven technologies to the industries.
3. **Technology Transfer Division:** This division is entrusted with technology dissemination for diverse groups of stakeholders in the food chain including those in educational institutions. Its functions involve training, demonstrations, holding workshops and seminars, exhibitions etc. The dissemination activities are conducted at the R&D center at Anuradhapura and field extension centers. This division caters to a large number of

stakeholders such as farmers/farm women, wholesalers, retailers, , processors, school children, university undergraduates, officers of the state institutions and NGOs.

4. **Laboratory Service Division:** This division provides various analytical services clients with reference to quality testing and certification for various food crops and value added products of agricultural commodities including water quality testing. The laboratories are also used for staff research projects and training of prospective entrepreneurs. Institute has planned to secure accreditation for its analytical and microbiological laboratories

5. **Planning and Monitoring Division:** This division was established in January 2017 headed by a research officer specialized in Agronomy. It plays a crucial role in the smooth functioning of the institute by preparing annual reports, annual action plans, progress monitoring and evaluation, preparation of reports and reviews etc. This division although not strictly Monitoring and Evaluation in the strict sense is handicapped due to lack of M&E programs and lack of qualified staff.

6. **Development Projects Division:** This division (DPD) was created in 2017 to ease the management of development projects at field level. This division undertakes implementation of development projects, mainly involved in solving field problems of stakeholders. It may be through improvement of knowledge or by providing facilities or equipment at subsidized rates or both.

DPD has only one research officer who is a member of the research division and at field level projects are implemented by the extension staff of the Technology Transfer Division (TTD). DPD projects are exclusively funded by the Food Security Program of the Ministry of Agriculture.

7. **Administration Division:** This division provides administrative support for the programs conducted by the institute. It provides a wide range of services such as human resources management, financial management and information management, facilities management, procurement and support services. It is also responsible for identifying human resources needs of the institute, staff recruitment, conducting performance evaluation examinations for staff, maintenance of institutes' properties, including issues involving legal aspects.

8. **Finance Division:** All financial matters of the institute are under the jurisdiction of this division. The preparation of the annual budget is a major responsibility of this division. The implementation of the budget and allocation for different activities and financial control according to existing financial regulations of the Government also falls within the preview of this division. This division also prepares regular financial reports for the Board of Management, Ministry of Agriculture and the General Treasury. The annual financial report for audit purposes is also prepared by this division.

9. **Internal Audit Division:** This division reports to the Chairman of the IPHT and oversees the legitimize the expenditure allocated for various activities of the institute and guide the institute to adhere to accepted financial regulations. It is manned by an Internal Auditor and few support staff and submits its reports directly to the Board of Management.

10. **IT Division:** IT Division was established in December 2016. Currently it is not functioning satisfactorily as the head of the division is on long-term study leave and the only staff is Management Assistant handling clerical and related matters. The updating of the website is also within the purview of this division. The institutes' library is also maintained by this division.

The new organization structure has not yet received approval of the line ministry and higher authorities of the government. These divisions are managed by senior researchers/divisional heads, but the review team noted that the staff is highly inadequate to handle the planned activities of all these divisions.

All field centers come under the direction of the Director of the institute and at field level each center is managed by a Senior Extension Officers and few support staff.

5. AVAILABILITY OF HUMAN RESOURCES

5.1 Scientific and Other Staff

The institute has a cadre of 39 scientific staff positions out of which 26 posts are filled. However, some key positions of the Institute remain unfilled. These include the posts of Director, one post of Additional Director R&TT, two posts of Principle Research Officer, one post of Principle Extension Officer, post of Economist, one post of Senior Research Officer, two posts of Mechanical Engineer and two posts of Extension Officers. The post of Director has remained vacant for some time. Currently this position is covered by an Acting Director (Table 1)

Table 1a. Scientific Staff of the Institute

Staff	Total Cadre Positions	Filled Cadre Positions
Director	01	-
Additional Director(Admin/F)	01	01
Additional Director(R&TT)	01	-
Principal Research Officer	02	-
Chief Mechanical Engineer	01	01
Principal Extension Officer	01	-
Senior Research Officer	03	02
Senior Mechanical Engineer	02	02
Senior Extension Officer	01	01
Research Officer	14	14
Mechanical Engineer	06	02
Extension Officer	05	03
Economist	01	-
Total	39	26

Table 1b. Scientific, Accounting and Administrative staff of the Institute

No.	Staff	Total Carder Positions	Filled carder Positions
01	Research and Development staff	36	25
02	Support staff	54	41
03	Librarian	01	01
	Accounting staff		
01	Accountant	01	01
02	Support staff	05	05

Administration staff			
01	Senior Managers	03	01
02	Administrative officer	02	01
03	Support staff	52	50
Other staff			
01	Internal Auditor	01	01
02	Support staff	01	01

The present staff is qualified in the broad areas of agriculture, Engineering, Science, and Food Science. A gender balance in the staff of the institute is clearly evident. Among the staff there are 03 Ph.D Degree holders, 03 M.Phils, 10 Chartered Engineers, 10 M. Sc and 04 B.Sc. degree holders. The scientific, accounting and administrative cadre include a total of 156 of which 32 posts are unfilled which include two posts senior managers of the Administrative division). According to the information provided by the institute 14 members of the scientific cadre have received higher level training in different aspects of post technology and related fields.

In 2016, IPHT has received approval for additional staff cadre, mainly extension and technical areas but not in research (Annex 3.)

IPHT has a history of fast staff turnover. The highlight of the deserting was when five extension field officers recruited recently leaving within few months of appointment. In spite of this situation IPHT has a wider vision of expansion with a larger lineup of new staff. All staff members showed dissatisfaction with the current remunerations they receive as per regulations governing state institutes, in spite of some getting allowances for paid research undertaken by IPHT. Though some staff has hierarchical positions, they are often internal classifications and positions are not necessarily tied up with incremental salaries.

Review mission could not ascertain the precise reasons for staff deserting as those who left the institute could not be interviewed. Interviewing the staying-back staff to elicit the reasons was not successful. It was sensed but could not be ascertained that there are workplace or prospects related matters that discourage some staff to stay long while for some others there may be overriding advantages to stay over. Thus, staff attrition was evident due to various reasons such as better terms and conditions elsewhere such as in the national universities, isolated location with limited facilities for children's education, limited scientific and social interaction, lack of facilities in the institute for social interaction etc.

As a result there is a serious dearth of scientific staff in this institute and the total R&D cadre as stated above is 36 out of which only 26 positions have been filled. The review team suggests the IPHT to re-assess the staff requirements against the current and future R&D programs and determine the staff requirements on long-term basis.

The shortage of scientific staff has been cited in the Self-assessment Report as a major constraint for implementing R&D programs of the institute. The institute has recognized the importance of developing competent and skilled manpower to make achievements in R&D activities. This is a crucial requirement for any R&D institute to develop the capacity of its members without which their outputs cannot be improved. Similarly, the competency of non-scientific staff has also to be consistently improved in support of the R&D activities. Qualified staff is the most valuable asset of any R&D institute.

During the last five years 2012 – 2016, only one officer has received postgraduate training under a Commonwealth Scholarship tenable in UK. Many staff about 70, has attended short training courses, seminars/conferences on various aspects organized by international and local agencies. It is desirable to take advantage of these *ad hoc* programs however; their availability will depend on the sponsorship by various local/international agencies (Annex 4).

The best approach for capacity building in any institutes will be by the formulation of a long-term Staff Development Program. It will address the whole chain of staff development from the stage of identifying staff requirements, staff recruitment with basic qualifications and accomplishment of required levels of qualifications for each Individual staff for career advancement. In this program training needs of individual staff has to be identified together with the potential training institutes either local or foreign depending on the availability of financial resources. The review team finds that in its lifetime the IPHT has not developed a comprehensive staff development program focusing on present and future activities.

6. INFRASTRUCTURAL FACILITIES

The institute is located on a 20 acre extent of land at Jayanthipura, Anuradhapura with buildings acquired from the Rice Processing Research Development Centre (RPRDC) which originally belonged to the Paddy Marketing Board (PMB).

The Institute has adequate infrastructure for the current activities of the institute. It has 02 administrative buildings, a Food Processing Unit, an Engineering Workshop for machinery design and fabrication, Primary and secondary processing unit (rice mill, grain and flour processing unit, bakery facilities, oil and spice processing facilities), Paddy and other grain storage facilities, a building for exhibition of machinery and equipment.

It has a well-equipped 3 auditoriums with seating capacity for 60, 80 and 120 persons, all equipped with audio-visual facilities. These are used for conferences/seminars and conducting training programs. The hostel with 10 air conditioned (AC) rooms and 20 non-AC rooms with dining and recreational facilities are used for residential purposes of visiting staff and trainees. There is also a building for staff accommodation.

6.1 Laboratories

The laboratories for chemical, physical and microbiological research which are well equipped with up to date equipment such as GCMS, HPLC, GC, atomic absorption spectrometer, microwave digesters, COD/BOD analyzers and other scientific equipment.

These laboratories need some more equipment to upgrade the quality of research and these include: Extruders for new product development and value addition, Freeze dryers for preservation of vegetables and fruits, Bomb calorimeter to determine heat of combustion or calorific value of materials important in food product formulation to measure energy, dietary fiber extractor/analyzer for extraction of dietary fibre and hot air dryer for dehydration of vegetables.

Recently, the institute has commenced an accreditation process for these three laboratories. This is a commendable decision. However, considering the present status of these laboratories, they have to be improved further in terms of the above equipment

and other facilities, competency and skillfulness of staff and more client oriented services to achieve the level required for accreditation.

These laboratories are used for servicing clients in quality testing and certification of cereals, pulses, oil crops, other field crops, fruits, vegetables, spices, value added products of agricultural commodities and drinking water and water used in industries. These services are on payment basis. These laboratories are also used for research and development purposes as well as for training of staff.

6.2 The Library

The institute has a library with extremely limited facilities. It is maintained by the IT Division. The library has a total collection of about 1700 textbooks and 33 journals in the broad areas of food processing and postharvest research. These old and obsolete publications are of limited use to the scientists of this institute. There is also no plan to procure books or journals and apparently related to lacks budget allocations. None of the available documents have been catalogued and they are scattered in the limited space in the library.

This library since the establishment of this institute has functioned without a librarian. For the first time a qualified librarian holding degree in Library Science has been appointed in January 2017. It is now opportune to improve this library to serve the scientific community of this institute. Immediately the available books and journals should be catalogued and computerized. The institute has to select and procure the essential books, journals and other documents that are useful for postharvest R&D and organize the library as an information and documentation center for future use.

Although there is no approved Master Plan for long term development of infrastructure of the institute, allocation of some funds (Rs.10 mn) to improve these facilities was noted.

The review team noted the poor maintenance of the entire building complex of this institute including the hostel, the water supply, roads and surrounding environment. Allocation of funds for maintenance of physical facilities should be included as a regular line item in the annual budget.

7. RESEARCH PROGRAM

The mandate of this institute is to undertake appropriate and cost effective research and development activities on postharvest processing and preservation technologies to reduce crop losses in the field, in storage, develop value added products, and prevent nutrition losses and promote consumption of foods of high nutritional value and to disseminate proven technologies among the urban/rural communities and the food industries for employment and income generation supporting the economic development of the country. Therefore, this institute has been entrusted with a major responsibility to achieve food and nutrient security and wellbeing of the people of this nation.

7.1 Research Staff

Research division commenced in 2002 has a cadre of 2 principle ROs, 3 senior ROs, and 14 ROs. As of end 2016 there were no principle ROs, only 2 senior ROs and 5 ROs, indicating a severe staff shortage. There had been no recruitments in 2016. After the 2017 new recruitments, there are 14 ROs in place. The designations of the staff are internal creations and not necessarily tied up with remunerations.

7.2 Research Process

IPHT conducts research on three broad themes namely:

- i. Postharvest handling and loss prevention,
- ii. Processing and value addition and
- iii. Food security and human nutrition.

The primary stage of R&D is the identification of potential research areas to commence investigations. Many researchable problems exist, but among them the most significant and timely problems have to be identified and prioritized. Several procedures are used in practice to identify research priorities such as literature reviews, field visits, scientific discussions, seminars/conferences and stakeholder meetings etc. IPHT conducts stakeholder consultations, problems in value chain through research-extension dialogues, with the participation of extension staff of other agricultural extension staff of the Department of Agriculture, Mahaweli Development Authority, private sector companies like Keels, Cargills to identify research problems. In the research agenda, the first meeting is called the stakeholder meeting, but the title is misleading and gives the research-identification process *an undue scientific rigidity*. When innumerable research areas are yet unknown, there are no specific pre-identified stakeholders. Further, the actual outsider participants of past such meetings were few clients who had obtained IPHT benefits on various matters and not necessarily on research topics finally selected and few outsider invitees. While the process is necessary, it has to be constituted under a different name.

Although this is an accepted procedure for research problem identification and prioritization, weaknesses exists due to the lack of serious commitment on the part of the stakeholders.

IPHT has established a Research Planning Committee consisting of 10 members from the state institutions and universities which meets twice a year to evaluate research proposals submitted by staff of the institute. The researchers present their proposals for evaluation and revised according to the comments of the above committee.

The review team suggests that the accepted research proposals by the above procedure should be subjected to an external review by two experts in the proposed research area in order to check on integrity of hypothesis, issues of duplicity, methodologies used, potential outputs, budget and any other issues..

Thereafter, the full research proposals should be prepared and submitted to the SLCARP. The approval of research proposals by SLCARP is reported to causes undue delays in the release of funds to commence the research projects. According to our information this is an Audit requirement. However, this issue has to be resolved by holding discussions with SLCARP.

The format used in preparation of research proposals as shown in the Performance Report 2016 has several deficiencies. Therefore, the IPHT should develop a standard Format for Research Proposal Preparation for use of its research staff. The following format is suggested:

1. Title of the project
2. Background and Justification clearly stating the problem
3. Broad Objective and specific Objectives
4. Materials and Methods
5. Duration (Date of commencement and date of termination)
6. Budget
7. Supporting documents such as CVs of researchers, List of recent (5) years research publications, letters of recommendation from the concerned institutions etc.

The formats are used by local funding agencies such as SLCARP, National Science Foundation (NSF) and National Research Council (NRC) could be used to guide in the development of this format.

The contract research projects with the private sector is highly encouraged by the institute for two valid reasons, firstly, the institute could assist in solving immediate problems of the private industries which is one of its mandated functions and a source of income to the institute and secondly, conducting research projects through the private industries with external funding makes researchers eligible for the 35% research allowance, an incentive for researchers provided by the General Treasury.

7.3 Research Projects

The IPHT has completed more than 150 research projects in the past years. Currently several projects are on-going under different funding sources. These include 10 Treasury funded projects costing Rs. 3.1mn, 02 Ministry funded projects with Rs. 2.04 mn, 02 projects with funds from the National Research Council (NRC), and the National Research Foundation (NSF) with Rs. 3.4.mn, 05 projects under Public – private partnerships and 11 Development project in 2016/17 (Annex 5). Action Plans have been prepared for all projects (on-going, new, external funded projects and technology transfer activities).

The public – private partnership (PP) projects are of particular importance as these are service oriented with direct relevance to the development and dissemination of postharvest technologies for the benefit of the clients. The involvement of scientific staff in these projects provides practical field experience while funds provided by the clients give additional income to the institute.

As stated earlier, the funds through outside sources also provide an avenue for the scientists to become eligible for the 35% research allowance granted by the Government. The state sector scientists are inadequately remunerated hence; establishing public – private partnerships will encourage scientists to undertake research with more dedication and commitment. The scientists have constantly raised concern regarding the delay in the approval of this allowance by the SLCARP which has been a great disappointment for many scientists. SLCARP should device means to minimize these delays.

In reference to development of machinery, during 1991- 1997 period under the RPRDC several types of grain processing (mainly for rice and maize) machinery has been developed and substantial number have been sold to customers. Since take over by the IPHT in 2000 this trend has been continued and number of different machines such as maize shellers, paddy drying machines, grain dehullers harvesters, pulping and grading machines, grain shifters etc. have been designed and developed for postharvest processing and value addition of different products. In the recent years, a rapidly declining customer demand has been observed, in spite of some having received patents. Many of this machinery remain at the IPHT as exhibits.

The situation with regard to use of machinery in the agriculture has been changing over the years in the Sri Lankan agriculture sector. A major issue that confronts the agriculture in Sri Lanka is the low supply and its high cost of agricultural labour. As a result the use of agriculture machinery has increased in Sri Lanka as in other countries of Asia. Asian countries like India, Thailand, and S. Korea has commenced machinery manufacturing industries and currently are major exporters. These machines are more refined; user- friendly, spares are readily available in the market and comparatively cheap. Sri Lanka has few small - time manufacturers with low investment capacity and unable to compete with foreign manufacturers and compelled to import various types of agricultural machinery and equipment.

Due to the above reasons, it is high time that the IPHT identifies the exact requirements of machinery needs for the country's agricultural sector and invest on those that have the highest commercial potential. Therefore, it will be necessary to redefine its objectives in regards to the design and manufacture of postharvest processing machinery for local clients.

7.4 Research outputs

During the three year period, 2013-2015, IPHT had undertaken 43 research projects (14, 11 and 18 respectively), of which 12 had been suspended for various reasons leaving only 31 effective researches projects for the three years. However during the five year period 2012-2016, IPHT had published 82 research papers in various international and local journals, symposium or conference proceedings. For an institute with a limited staff, notable staff turnover and around 10 completed research projects per year; statistically it is a remarkable output.

7.5 Need for recognizing new research frontiers

(i) Environment-friendly technology development and dissemination

Keeping up international environmental agendas and UN approved Sustainable Development Goals (SDGs) several obligations have to be considered by the research institutes. IPHT lacked emphasis on environmental and food safety research focus which are global issues that will encompass the millennium development issues.

The recent government decision to ban many synthetic packing materials with time lines should be an eye-opener and a great opportunity for IPHT to become the **National Focai Point for Environment-friendly Postharvest Technology Development and Dissemination**. Armed with a recent batch of new technical recruits to the institute, the IPHT is blessed to launch fresh initiatives in the above lines.

However, the time is opportune to prepare enhanced investment programmes immediately to grasp the budgetary allocations for 2018. Treasury authorities could easily be convinced, supported by the government's environment friendly policies.

The institute should take the initiative, perhaps with its collaborating organizations, to canvass government support to nominate it as the National Focal Point for Environment-friendly Postharvest Technology Development and Dissemination.

(b) Use of irradiation technology for selected commodities

The food commodity irradiation process has been approved by the Food and Agriculture Organization (FAO), the World Health Organization (WHO), the International Atomic Energy Agency (IAEA) and the *Codex Alimentarius* Commission. About 100 countries have approved the process for application in more than 100 food items. India first approved them in 1994. <http://www.vigyanprasar.gov.in/Radioserials/food%20irradiation>. The UK allows importation of irradiated food with certain conditions and standards regarding the process of irradiation. IAEA reports that requests for technical assistance have been received from developing countries, Brazil, Chile, Ecuador, Egypt, Indonesia, the Islamic Republic of Iran, Jordan, Mexico, Morocco, Nigeria, the Philippines, Saudi Arabia, the Syrian Arab Republic, Thailand and Uganda for food irradiation as far back as 1994. <https://www.iaea.org/About/Policy/GC/GC38/GC38Documents/English/gc38-6>. Even Bangladesh has taken the initiative to install low capacity irradiation machinery more than 20 years ago.

Sri Lanka may benefit from the technology at least in selected commodities. The country faces losses in onions, potatoes, cut flowers, cereals and animal products which could be protected with low doses of irradiation. The expanding cut flower and foliage industry could be the first liners to benefit because the products are not consumed and their shelf life is greatly enhanced with irradiation.

7.6 Dissemination of Research Outputs

IPHT conducts research which are more oriented towards career development and the results are published in scientific journals. Therefore the research findings of staff are disseminated through publications in local /international scientific journals, proceedings of conferences/symposia etc. IPHT also organized biannual research symposia in 2012 and 2014 at which event the R&D findings of staff are presented to the stakeholders and published as proceedings. The review team noted the practice of holding annual symposia has not been continued since 2016. After completing research projects workshops are conducted to create awareness among the stakeholders after which research notes are published to disseminate technologies through the extension division.

During 2012 – 2016 a total of 65 research papers have been published in prestigious journals, symposia/congress proceedings. Considering the facilities available at this institute, this is a commendable achievement of the institute.

There are also many other publications such as books, bulletins, newsletters produced at various times and these are available freely for the stakeholders. The review team noted the absence of a Publications Committee to formalize the publication process of this institute.

It is clear that research findings have not adequately filtered to the public. The technology transfer activity should be reformulated focusing the public needs and how best to utilize all the research findings.

7.7 Patenting of High Quality Research Outputs

The number of patents Registered in a specified period is an indication of an institutes' research achievements in terms of quality and relevance. Therefore, the institute promotes patenting of outstanding research findings of staff. It is creditable that the institute has obtained 06 patents for its research findings as listed in Table 2.

Table 2. Patents Registered by the IPHT

Title of project	Name of inventor	Patent No.	Year
1. Development of a continuous paddy steamer-	T.M.R. Dissanayake	16904 A23L 1/82	2012
2. Production of instant soup cube	S.H.Jayawardena	15320 A23L 1/00	2009
3. Development of lipid based edible coating (wax) for fresh fruits	R.M.N.A.Wijewardena	16622 A23B 7/16	
4. Design and development of a grading machine for big onion	Champathi Gunathilake	15970 B07B 13/00	
5. Production of rice based ice cream (Rice cream)	H.S.Jayawardena	16623 A23G 9/00	
6. Development of steam sterilization machine	T.M.R.Dissanayake	16903 A23L 3/00	

The ownership these patents are with the institute. The review team noted that none of these patents commercialized and it appears that no attempt has even being made to commercialize them, although this should have been addressed by the institute.

The institute has also not developed a procedure for sharing benefits arising from commercialization of patents between the owner and the inventors. The availability of such a procedure will promote high quality research besides the financial benefits to the institute and the researchers.

7.8 Rewarding Research Excellence

The staff of the institute has received five (5) Presidential awards for scientific publications in indexed journals. The institutes' Senior Mechanical Engineer was the recipient of a Presidential Award and Patent on his research project on Steam sterilization for dried pepper in 2015. He also received a Merit Award and Patent for another research project on Continuous Steamer for Paddy in 2015. Another merit award and Patent was received by Senior Scientist for developing a Wax solution for fruits in 2015. Some researchers of this institute have also received recognition for their presentations at various scientific events held locally. These are excellent achievements which raise the image of scientists and that of the institute (Table 3).

Table 3. Presidential Awards Received by Researchers of the Institute

Name of awardees	Title of Project
1. Dr. Lasanthi Jayatunga	Extension of postharvest life of oyster mushroom using modified atmosphere packing technique
2. Ms. Ruwanka Ratnayake	Control of <i>Aspergillus</i> rot in wood apple
3. Dr. Nilanthi Wijewardena	Development of lipid based edible (wax) for fruits
4. Eng. Mahesh Dissanayake	Steam sterilization machine for dried pepper
5. Eng. Mahesh Dissanayake	Continuous paddy steamer

The recognizing the achievements of scientists is a cost-effective instrument to develop the capacity of an institute. It will encourage scientists to undertake effective research with more dedication and commitment.

However, the management of the institute has not developed a scheme to recognize and reward meritorious scientific achievements of its own staff.

B. DISSEMINATION OF RESEARCH AND DEVELOPMENT INFORMATION OF THE IPHT

The dissemination of research information is carried out through the Technology Transfer Division (TTD). TTD has a cadre of 01 Principle Extension Officer, 01 Senior Extension Officer, 05 Extension Officers and 10 Extension Field Assistants. During 2016 there were no principle extension officers, only 04 extension officers and 05 extension assistants. There had been no filling of vacancies in 2016. The vacancies of extension assistants (Diploma in Agriculture) had been filled in 2017, but for reasons unclear, all had vacated within two months of recruitment.

TTD in collaboration with other divisions of IPHT is responsible for technology transfer on postharvest activities through residential training, field extension training and activities such as demonstrations, field days, radio and TV broadcasts, newspaper articles etc. TTD prepares the necessary extension material such as leaflets, handouts, and bulletins.

TTD has seven Extension Centres with offices located in other institutions in Kurunegala, Kandy, Nuwaraeliya, Ampara, Hambantota, Mullaitive, and the Anuradhapura office at the IPHT. All offices were planned to be staffed with one extension officer and one field officer; yet Kurunegala, Kandy and Mullaitive offices have only Extension Officers and all others have only Extension Field Assistants. As the seven extension centres cover all the districts, the field extension arm of TTD is grossly understaffed.

IPHT is planning to have new centres (total of 25) and new staff (total of 20 Extension Officers and 40 Extension Field Assistants) to have an all-district extension network.

The main activities of the TTD are to administer the ambitious and problem solving oriented field programme "improvement of supply and value chain management practices of mango", conduct regular training sessions at the seven extension centres and Training of Trainers (TOT) with agricultural instructors of DOA (not in 2017 for want of funds). It also takes part in IPHT regular residential training programmes.

Each extension centre conducts 2-3 training classes per month. Each one-day training class has well planned agenda. The program items include creating awareness on the current postharvest losses, postharvest technology available with IPHT for paddy, rice, grains, pulses, vegetables, spices etc. Processing, value addition and marketing aspects are also covered. The training programs are organized in collaboration with other relevant institutes in the district. On face-value of the agenda, time allocation and topics seem to be balanced and comprehensive. However, the depth of coverage and whether they address the actual needs of the trainees could not be assessed without attending a training session.

The volume of work handled with a limited and scattered staff is commendable. The field arm of TTD in spite of not having own offices function satisfactorily with limited resources.

8.1 Need for Publicity Division

The review team noted that the research outputs and other scientific information produced by the IPHT have not filtered to the public and this is an important missing link in the research-development continuum. As stated earlier, IPHT has produced a large number of publications in the past without any specific focus which has constrained transfer of information reaching the majority of stakeholders.

The review committee is of the view that at the present stage of development the IPHT should dedicate itself more for the provision of publicity of research and extension information by establishing dedicated Publication Division to create public awareness and visibility of the institute (see 13. Recommendation- Issue of inadequate visibility).

A Publicity Division within IPHT would have following general and specific functions.

- Assembling IPHT technical materials (research outputs, research reports, news on new engineering designs and innovations etc.) to edit and recast them as publications or mass media material on a day-to-day basis.
- Publishing of such reformulated scientific, technical and extension related materials on media easily accessible to society.
- Providing wide publicity on the Institute's activities to specific stakeholders as well as to society at large regularly and repetitively to create a highly demanded environment for IPHT research outputs, advocacy and custom tailored services.
- Providing IPHT information to other Institutes for liaison services and to media houses for public broadcasting.
- Covering IPHT events with photography on social media and conducting on-site opinion interviews from those who participate in the events.
- Providing support services to IPHT work such as exhibitions, fairs, field days, technology transfer division training and other work and gathering feedback and field situation information to feed the research division, technology transfer division to mould their work accordingly.
- Storage and updating of publications produced by the publicity division.

R & D LINKAGES WITH OTHER INSTITUTES

The development of links with other similar institutions is an essential component for fostering R&D activities of any research institution. These linkages provide scientific interaction among expert staff, sharing of resources and information exchanges. These linkages will elevate the image of an institution in the public eye, provided that the links with recognized institutions. In

In this regard to this the review team noted that the IPHT has developed several informal linkages with universities; the Universities of Peradeniya, Rajarata, Uva Wellassa and Wayamba. Some of these include collaborative research programs with universities with the involvement of academic staff and students who undertake short term research projects as part of their final year degree level training. Some of the IPHT staff also supervises postgraduate research of university students. There are several R&D programs under public – private partnerships, but all these links are with individual researchers and not on institutional basis (Table 4)

Table 4. The Collaborative Research Projects Universities

Name of researcher	Title of project x	University
1. S.D. Samaradiwakara	-	University of Peradeniya
2. K.G. N. Madumali Gamage	omit this column	University of Uva Wellassa
3. Asanga Kumari	-	University of Rajarata
4. M T M Thanish	-	Wayamba University

While appreciating the above, the review team finds no evidence of any formal linkages with either local or international research organizations. The establishment of formal linkages under Memoranda of Understanding (MOUs) is an accepted method of establishing viable partnerships as they are more binding with greater commitment of the partners and assures sustainable outputs.

The review team noted instances where such formal links should have been established. For instance there are several key national institutes (Industrial Technology Institute (ITI) and (National, International Atomic Energy Authority,(IAEA), Engineering Research and Development Center (NERD), Farm Machinery Research Centre, FMRC) which are engaged on postharvest research and development, also there are many food technology and engineering faculties/departments in the universities which undertake research similar to that of the IPHT and production and primary processing oriented institutions like the Department of Agriculture, especially, the Fruit Crop Research & Development (FCR&DI) is currently engaged in similar research. These can be useful partners to facilitate and accelerate the R&D programs of the IPHT.

10. DEVELOPMENT PROJECTS PROGRAM

This is a new initiative (DPP) of the institute to promote postharvest technologies among many stakeholders, mainly the potential entrepreneurs. DPP has no permanent staff and the entire program at field level is handled by the staff of the Technology Transfer Division (TTD). As this program is likely to benefit the public directly, it should be strengthened with more staff, facilities and funds for project implementation and monitoring and evaluation at district level.

Development projects are of recent origin and implemented for the improvement of supply and value chain of different crops is studied. One of these projects on mango has commenced

in 2016 and another three projects on papaya, banana and guava are due to commence in 2017. In these value chain management projects Training of Trainers (TOT) on postharvest loss reduction in agricultural crops and Induction of fruit ripening by organic methods, harvesting etc are studied. The project on the value chain improvement on mango at Omaragolla was started in 2016. This is a challenging project as many questions regarding its long-term sustainability may arise.

As stated earlier, the mango project is a Development Project activity handled by TTD. The project proposal is of high standard, comprehensive, covering all crucial elements of a project including the problem analysis, justification, general and specific objectives, target group, methodology, activities and action plan. Benefits to the environment, gender participation, household incomes, and sustainability are all addressed in the proposal. The three year project is on-going and initial benefit assessment has shown post-harvest fruit loss has decreased from 35% to 5%.

The mango project is funded by the Food Security Program of the Ministry of Agriculture. Though Rs. 25.9 Mn is estimated for 2017, no funds have yet come from Food Security Programme and only five months remain for the year.

The review team suggested paying attention to formalize the production process by encouraging growers to establish small orchards using improved varieties of mango as currently used products are from unselected, aged and scattered trees grown in home gardens. Such improved varieties of various fruit species are available at the Fruit Crop Research & Development (FCRDI), Horana. Also, to promote the growers register in societies to make them stable and make them eligible for microfinance facilities and focus on developing these as a business model.

For 2017, there are three Improvement of supply and value chain management practices projects to the value of Rs. 19.79 mn. The initial work of these projects are funded by the IPHT as funds from the Food Security Program have not been released. An inordinate delay in releasing of funds by the Ministry has to a great extent hampered the progress of these projects. It may be due to shortfalls in budgetary administration and management. The review team suggested undertaking a problem – tree – analysis on budgeting, funds requesting, ministry processing and take corrective action to get the funds in the first month of the year.

11. STAKEHOLDER SERVICES

The institute provide multitude of services to diverse stakeholders. Extension and training is a major component of this institute. The institute conducts about 20 training programs of 01 -02 days duration per year. According to the requirements of the clients different tailor-made training programs are also held. These are provided as residential and non-residential training programs. The clients include fruit and vegetable collectors, grain processors, government officers and NGOs, school children, students of technical colleges, universities, small and medium entrepreneurs, different groups of processors.

The institute also has a Consultancy Committee which meets twice a year to discuss the consultancies which are designed to improve the efficiency and productivity of local postharvest and processing industries.

The institutes' consultancy services cover trouble shooting for existing plants, the establishment of new food processing plants, designing of factory layout/process line, design of factory /storage buildings, cost: benefit analysis, energy and waste management, quality and safety implementation, environmental protective measures, preparation of technical and feasibility studies, conducting feasibility studies. Scientific staff also works as consultants for larger scale projects. For farmer/cottage level entrepreneurs and beneficiaries of IPHT development projects the consultancies are provided free of charge. The services for small, medium and large industries fees will be charged at rates published by the IPHT. During 2013 -- 2015, 163 consultancies have been conducted by the IPHT.

For accounting purposes, disbursements of consultancy charges have been formalized which enables scientists involved in these consultancies to benefit financially. After deducting all the direct costs, 20% of the total revenue will be retained by the institute, Another 10% will be retained by the IPHT to meet other overhead costs such as utilities and minor laboratory/workshop charges . 70 % is paid to the staff involved in the consultancy, and distributed according to the contribution of each individual.

12. ANNUAL BUDGET AND ALLOCATION OF RESOURCES

IPHT receives funds from many sources: Treasury funds, ministry funds (food security programme), research grants, private sector entrusted research funds and from consultancies and services. It is reported that on face value funds approved are sufficient for the planned annual programme. (Table 5). However, delays in release of funds and approval to commence the use funds has caused serious detrimental consequences to implement a sustainable research and development programs.

Table 5. Budget for the period 2014 – 2016 and Expenditure for the period 2013 – 2015

Source of funds	Amount (Rs)		
	2014	2015	2016
Treasury	66,260,000	85,139,000	99,750,000
Others	6,535,757	966,239	23,496,864
Total	79,795,757	86,105,239	123,246,864

Votes/ Activities	2013		2014		2015	
	Allocated	SPENT	Allocated	SPENT	Allocated	SPENT
Personnel	54,024,250	55,868,238	67,389,000	68,737,110	81,890,171	730,974,38
Emoluments	1,700,000	1,590,523	1,900,000	988,069	150,000	183,353
Travelling	4,510,000	3,290,276	5,010,000	3,158,172	431,000	395,689
Supplies	5,600,000	5,631,555	5,000,000	2,590,835	525,000	303,640
Research	8,120,000	7,332,932	8,200,000	7,443,470	870,000	823,764
Maintenance	3,900,000	3,147,146	4,425,000	3,695,220	432,500	405,737
Contractual	77,854,250	76,860,670	91,924,000	86,612,876	105,975,171	94,219,274
Total						

The allocation of funds in Table 5 above has shown an increasing trend over the years, which is encouraging. The funds received through other sources have also increased. The allocations and expenditure (Table 3) shows that the funds allocated has been spent in years 2013 – 2015.

The review team observed that the IPHT has developed a tradition of sending the research proposal to CARP for approval even for Treasury funded research proposals. Even if the need is justified technically, the delay of often 6-8 months to get the approval is highly unsatisfactory. This has discouraged the staff deeply, losing the initial enthusiasm. It had been the most frequent audit query when research had been started pending approval from CARP. This has been a major concern for finance division. This procedure and delay is irrational as the funds are from the Treasury and not grants funded.

Identical situation of delays of more than 8 months was highlighted in section on Ministry funds for development projects. The consequence on the staff imparting dissatisfaction is same as above.

13. ISSUE OF INADEQUATE VISIBILITY AND LIMITED PUBLIC IMAGE

Inadequate visibility: IPHT has diverse R&D programs ranging from cereal technology, postharvest processing and value addition to fruits and vegetables, spice crop product improvement and several development programs. Many extension programs are also implemented on regular basis which include capacity building in the broad areas of postharvest technology and in this field much has been achieved. Several collaborative programs also exist with universities and the private sector industries which strengthens the institutes' capacity for high quality research. Innumerable services are also provided to the stakeholders including quality maintenance of agricultural products. However, the institute lacks an effective system for creating public awareness of its programs.

Due to the above reason, much of good work of IPHT had not filtered to the public at large was obvious during deliberations with staff of all the divisions, senior staff of IPHT as well as when examining the program activities. In fairness to all, the research staff had undertaken and completed the research and the technology transfer staff had focused more on ground level training and related matters as well as producing extension leaflets.

Visibility can be improved with modernization of postharvest research and development programmes. IPHT appears to have delved in old and proven technologies for several decades. The time is now ripe to introduce modern postharvest concepts and technologies and change the public image of the institute and provide leadership to the local industries in par with counterparts of the developed countries.

All divisions of the institute, in particular the Technology Transfer and the IT divisions with inputs from other divisions should provide leadership in creating public awareness programs through radio and TV s in all three languages for target audiences such as new entrants to the postharvest industry, school children and the general public. In support of, the establishment of a Publicity Division has been suggested elsewhere in this report (see 10.1).

IT is an important area in office management and dissemination of knowledge. It should be fully integrated with main divisions of IPHT. IT division needs to be upgraded with more staff, modern equipment and responsibilities. It should develop to be an effective partner in postharvest

technology publicity, preparing TV, radio programmes, web advertising etc. it should be linked with the proposed publicity unit.

14. COMMENDATIONS AND RECOMMENDATIONS

14.1 Commendations

1. The institute has made considerable progress in research and development initiatives as evident from research publications, usable R&D outputs, design of new machinery and equipment, Presidential research awards and Patents registered during the past years.
2. Commendable progress have also been made in extension and training of various stakeholders in different areas of postharvest processing and value addition technology to assist the farming communities, food processors and the food industry.
3. Infrastructure and basic facilities improvement particularly the research laboratories in support of R&D activities and training and the initiation of accreditation for laboratories was evident.
4. The Website informs the clients on current development activities and training programs and other initiatives of the institute .

14.2 Recommendations

1. Maintenance of good governance

- i. Develop a **time-bound Strategic Plan** for the overall development of the institute with clear Vision and Mission statements, Goals, precise Objectives, Strategies to achieve the set objectives with Key Performance Indicators (KPIs) over a specified time period , preferably 5 years (Log frame planning and monitoring).
- ii. Develop a **Code of Ethics** for all employees of the institute and **Code of Research Ethics** for scientific staff of the institute
- iii. Development of a **Master Plan** for long term improvement of infrastructural facilities to meet the present and future R&D and other requirements of the institute.

2. Research problem identification and prioritization

- i. As an alternative to the present stakeholder meetings, IPHT should develop an effective **consultative process** involving relevant research institutes, line departments, and extension personnel, processing industry and marketing businesses to identify problem areas needing urgent research. It should give priority to demand driven research in order to achieve significant outputs useful to society and be accountable for the use of public funds.

After approval of the Research Committee, the proposal should be subjected to an **external review** by two experts knowledgeable in that field and their comments should be incorporated in the final proposal prior to submission to SLCARP. These procedures will accelerate the approval of the proposals by SLCARP.

- ii. For prioritizing research, a system of scoring by assigning weights based on (a) expected research outputs (b) technical feasibility and commercial viability of the outputs (c) impact on the economy and (d) availability of resources may be used .
 - iii. Develop Guidelines for Research Proposal Preparation with a standard Format to facilitate researchers to formulate appropriate proposals and introduce mechanisms for periodic research reviews, monitoring and evaluation of research through internal/external expert committees.
 - vi. Re-visit the objective of design and manufacture of postharvest machinery and equipment with reference to their relevance under local conditions, cost effectiveness and competitiveness from imported machinery.
 - v. Strengthen the Research- Extension Dialogue by including all relevant stakeholders from state organizations, private industry, universities, farmer groups and NGOs and to identify and prioritize research and develop a comprehensive long-term Research Plan and an effective feedback system.
 - vi. Monitoring and evaluation division should be strengthened with M&E qualified staff and assigned specific responsibilities to assist in decision making at management level.
 - vii. To encourage high quality research for commercialization and patenting and develop a scheme for sharing of benefits among the inventors and the institute.
 - viii. Establishment collaborative research partnerships by entering into formal Memoranda of Understanding with advanced local/international research institutes, universities, NGOs and private industry.
 - ix. IPHT should consider every research programme in the context of environment friendliness and food safety. Innovative use of locally available materials for all food technology, packaging and transport improvement should be prioritized. Use of traditional knowledge and local materials in postharvest operations will generate brand new industries especially at village level and provide many employment opportunities.
 - x. IPHT should explore the possibility of using irradiation technology on improving postharvest technology. IAEA could be the initial resource base if the Atomic Energy Commission would approve.
 - xi. As there is an emerging trend for quality assurance of agricultural products and value added new products, the laboratory services should be improved with qualified scientific staff and laboratories equipped with more advanced analytical equipment to cater to the current client needs and future global trend of the food processing sector.
- i. **Human resources development and management**
- i. Develop an approve a procedure and establish a **Staff Development Program with an Officer in Charge** to identify training needs of both scientific and administrative staff for career advancement, formulate training modules and identify potential training institutions.
 - ii. Establish and implement a Performance Appraisal and Reward Scheme for all employees of the institute.

- iii. Develop and implement a scheme to recognize and reward outstanding achievements of research and extension officers and all other staff of the institute.
 - iv. Examine the reasons for non-retention of research and extension field staff, as the turnover was very high. Corrective actions need to be taken at all times, and particularly before making new recruitments. If there is an inherent issue in the work environment, remuneration or in career advancement forcing recruits to use IPHT only as a temporary platform, it needs to be thoroughly investigated and rectified.
4. Information dissemination and creation of visibility
- i. As much of the valuable information on postharvest processing technology generated by the IPHT has not filtered into the public domain due to lack of an effective mechanism for linking its activities with the public at large. Therefore, a fully pledged **Publicity Division** should be established to handle all aspects of publicity of research findings and other extension programs, events etc., offered by the institute. A mandate for this division should be developed in consultation with other partners. This division should be headed by an officer skilled in development and offering of publicity programs.
5. Strengthening Financial Management
- i. Establish a **Finance Committee** and an **Audit Committee** together with a comprehensive set of Terms of Reference for financial control and to streamline all financial transactions.
6. Approval of research projects by CARP
- i. An assessment of the need to send Treasury funded proposals to SLCARP for approval has to be fully justified. As setback due to prolonged delay outweighs the benefits if at all, by sending the proposals to SLCARP. It should specify the reasons why they want the proposals which have received approval from the institute to be reassessed. The procedure outlined in approving proposals at institution level may help to resolve this issue (see under 2).
 - ii. On similar lines discuss with the Ministry the way to have the funds in the first month of the year. Problem tree analysis was suggested under Development Projects Division review.

ANNEXURES

Annex 1. Terms of Reference of the external review of the Institute of Postharvest Technology

Scope

1. To achieve the objectives of the review, the review panel is expected to play particular attention to the following aspects:
 - a) Mission of the institute and its interpretation with respect to:

Research R&D focused on immediate and long term postharvest handling needs in Sri Lanka:

 - Policies and directive of the SLCARP and the Ministry of Agriculture regarding the appropriateness of IPHT's Mission in the light of important changes taking place in agricultural production and product development in Sri Lanka
 - Appropriateness of the roles of relevant partners in the formulation and implementation of IPHT's research strategy and priorities
 - Conservation of natural resources, impact of IPHT's practices on natural environment and long term environmental sustainability.
 - b) The objectives and relevance of the present program of work, budget and forward plans for the next 5 years in relation to:
 - The IPHT's mandate and its criteria for allocation of resources and planning procedure adopted by IPHT and the mechanism for their formulation
 - The IPHT's rationale for its present allocation of resources among research, extension information exchange and other activities.
 - c) The content and quality and relevance of scientific work with particular reference to:
 - The results of research during the past 5 years and their practical applicability and economic feasibility and impact on the agricultural sector
 - The current and future research plan and the role of various scientific disciplines therein
 - The degree and extent to which the specific needs of various stakeholders were studied and analyzed in the formulation of the past and present research plans
 - The information exchange and extension programs and the participation of research staff therein
 - The adequacy of research support and facilities
 - The management of the scientific and financial resources of the IPHT and the coordination of its activities
 - Level of national and international recognition of the IPHT and its scientific staff
 - Cooperation/collaboration with universities, regional and international research organizations
 - Adequacy of publication of research findings.
 - d) Impact and usefulness of institutes' activities in relation to:
 - The record and potential impact of the IPHT's research
 - Cooperation with other research institutes and with national development programs, private sector organizations and other stakeholders

- e) Examine the extension program of the IPHT to determine:
 - Its effectiveness in the agricultural sector
 - The effectiveness of the information exchange program and timeliness, quality and relevance of the technologies generated and its publications
 - Mechanisms adopted to get the feedback of stakeholders in planning future R&D
 - The identification of problems and constraints impeding the extension program
- f) The quality and effectiveness of the management of the IPHT in relation to:
 - The constitution of research, advisory or sub committees of the Board
 - Adequacy of coordination to ensure excellence of the research program and related activities
 - Competency and professionalism of the directorate and senior management of the IPHT and the definition of roles, organization and quality of the leadership of the IPHT and rapport with the staff
 - Nature of the budgetary review and evaluation process and the involvement of important stakeholders in the above, stability of funding and the relationship budget, institutes policies and plans and the effectiveness of utilization
 - Procedure for determining staffing requirement at all levels for selection evaluation and compensation of staff
 - Administration of fiscal, purchasing and supply of personal computers, housing and other facilities including transport and general management services and their effectiveness in supporting scientific staff.
- g) Services provided by the IPHT:
 - Consultancy and advisory services
 - Laboratory services
 - Pest control and fumigation of warehouses
- h) Overall analysis through:

A SWOT analysis to identify internally controllable and uncontrollable factors

Annex 2. Members of the Board of Management

Mr. Kavinda C. Dissanayake, Chairman

Mr. R.P.A..Ranaweera Pathirana, Vice Chairman

Mr. K.W.E. Karaliyadda Director

Mr. R.K. Priyantha Jayatissa, Director

Mr. M.S.Karunaratne Director

Mr. S.P. Kumara Gunaratne, Director



Annex 3. Additional Cadre of IPHT – 2017

Extension officers	20
Accountants	02
Technical officers	02
Administration officer	01
Extension assistants	40
Management Assistant	30
Laboratory Assistants	06
Drivers	10
Security Guards	10
Maintenance helpers	05
Labourers	02
Labourers (sanitary)	05
Total	111

Annex 4. Staff trained last five years (Foreign)

Name of officers	Country	period	Scholarship
YEAR 2012			
Ms. K.G.L.R. Jayathunga	United Kingdom	2012.11.01 – 2015.10.13	Commonwealth Postgraduate Scholarship tenable in the United Kingdom
Mr. D.M.C.C. Gunathilake	Manila Philippines	2012 July 09-14	Training Course of value additional to agricultural Product for greater Access to new market
Mr. C.R. Gunawardhana	Vietnam	2012.07.23 2012.07.25	Characterization of Fresh and Processed Fruit Quality
YEAR 2013			
Ms. R.M.N.A. Wijewardhana	India	2013 August 5 th - 8 th	Visit Amity University Sector 125 Express way Noida Uttar Pradesh
Mr. B.M.K.S. Thilakarathne	Indonesia	2013 September 23 th – 27 th	Workshop on Emerging post harvest technology for Fresh fruits and Vegetable
Ms. B.M.K.S. Thilakarathne	India	2013 January 10-12	Invitation for Delivering Key Note Address in 1 st Informational Conference and Workshop at NIFTEM
YEAR 2014			
Mr. D.P.C. Swarnasiri	China	2014 November	Fruit and Vegetable Products
Mr. D.P.C. Swarnasiri	Bhopal MP India	2014 February 10-24	Equipment and technology for Processing and Value Additional to Agricultural Rural Products at Small scale/ Rural level Central Institute of Agricultural engineering (CIAE)
Mr. W.M.C.B. Wasala	New Delhi India	2014.03.24 – 2014.03.28	Workshop on Development of Cold Chain System for perishables Agree food Products
Mr. H.M.A.P. Rathnayake	Thailand	2014 August 16-19	Scaling up Rice Fortification in Asia
Ms. R.M.N.A. Wijewardhana	Pakistan	2014 January 20-24	Workshop on Risk Management of Food Borne Pathogens
Ms. B.M.K.S. Thilakarathne	China	2014.10.14 – 2014.10.22	Conton Trade Fair, Guangzhou

YEAR 2015			
Mr. D.P.C. Swarnasiri	Bangkok Thailand	2015 June 07-20	1 st AFACI International Workshop
Mr. C.R. Gunawardhana Mr. A.M.G.C.P. Kumara	India	2015/03/01 – 2015/03/07	Procumbent of supply Delivery Installation Commissioning training and Maintainers of analytical laboratory Equipment of Existing
Ms. C.A.K. Dissanayake	Bhutan	2015 November 9 th – 4 th December	Training Programs on Vegetable from Seed to Table and Beyond AVRDC the world Vegetable center
YEAR 2016			
Mr. C.R. Gunawardhana	Bangkok Thailand	2016 November 14- 18	Regional Training Workshop On Heretical rural Chain management
Ms. R.M.N.A. Wijewardhana		2016 September 14- 30	Modern Agricultural Management for Official from Countries along the land and maritime silk Roads
Mr. B.D.M.P. B. Dissanayake		2016 September 14 th – 30 th	2016 Seminar on Modern Agricultural Management for Officials from Countries along the land and maritime Silk Roads
Ms. C.A.K. Dissanayake	Paro, Bhutan	2016 September 26- 30	Training of Trainers on horticultural Chain Management
Mr. M.M. Herath	Bangkok Thailand	2016 November 14- 18	Regional Training Workshop on horticultural chain Management
Ms. R.M.R.N.K. Rathnayake	Paro, Bhutan	2016 September 26- 30	Training of Trainers on Horticultural Chain Management

Staff trained last five years (Local)

Name of officers	Institute	Duration	Training
Year 2012			
Mr. R.M.D. Rathnayake Ms. K. IssankaSahamali Ms. B. DushyanthiCharika	Ministry of Agriculture	2012.01.26	One day Training on Salary preparation
Mr. R.M.D. Rathnayake	Milado Institute	2012.04.18	Disciplinary Management Training Programe
Mr.J.K.Paranawithana Mr. P.A.C. Sampath	Industrial Solution Lanka (pvt) Ltd	2012.08.05, Sunday 04	Safe operation of high Risk Machinery Including Steam Boilers

Year 2013			
Mr. R.K.A.P. Ramanayake Mr. R.M.D. Rathnayake	The Institute of Chartered Accountants of Srilanka	2013.01.30	Awareness Programme on Sri Lanka Public Sector Accounting Standards
Mr. R.M.D. Rathnayake Mr. U.P.N.R.Piyasinghe Ms. K. IssankaSahamali	The Institute of Chartered Accountants of Srilanka	2013.08.05 – 2013.08.09	Training on Government Payroll System
Mr. R.K.A.P. Ramanayake	The Institute of Chartered Accountants of Srilanka	2013.04.05	How to minimize audit queries and improve public accountability
Mr. R.M.D. Rathnayake	Prag Institute	2013.04.02	Internal Auditing Training Programme
Mr. R.K.A.P. Ramanayake	Prag Institute	2013.09 , 4 - 5	Awareness programme on Sri Lanka public sector accounting standards
Mr. C.R.Gunawardhana	Industrial Technology Institute	2013 .09 , 26 - 27	Safety in chemical and microbiological laboratories
Mr. R.M.D. Rathnayake	Industrial Service Bureau Auditorium	2013.10.10	Japanese grant aid for human resource development scholarship promotional seminar
Mr. R.M.D. Rathnayake Ms. K. IssankaSahamali Ms. B. DushyanthiCharika Miss. M.G.S.Dilhari Miss. R.H. Upeksha	Ministry of Agriculture	2013 .10 31 - 2013. 11 . 01	Japanese grant aid for human resource development scholarship promotional seminar
Mr. P.J. Subashinghe Mr. U.P.N.R.Piyasinghe	Skills Development Fund LTD	2013.11.28	Practical Aspects of Bid Evaluation
Year 2014			
Mr. I.M.N.P.Ilangashinghe Mr. R.M.D. Rathnayake Miss. T.P. Rubashinghe	Ministry of Agriculture	2014.06.16 , 17	Training on F/R 104 relevant to Investigation
Mr. I.M.N.P.Ilangashinghe Mr. R.M.D. Rathnayake Miss. T.P. Rubashinghe Ms. B. DushyanthiCharika	The Institute of Chartered Accountants of Sri Lanka	2014.05.29 2014.06.05	Public Sector Accounting Standard
A.G.Rangajeewa	Prag Institute	2014.08.13	Seminar On Bidding Document

Mr. Dr. B.M.K.S.Thilakarathne Mr. D.P.C. Suwarnasiri Mr. I.M.N.P.Ilangashinghe Mr. A.G. Rangajeewa	Skills Development Fund LTD	2014.10.04	Seminar On Bidding Document
Mr. P.J.Subashinhe	Skills Development Fund LTD	2014.10. 30,31	Confirm for participation on workshop on internal management system at government institution
Mr. I.M.N.P.Ilangashinghe Ms. M.A.M. Priyadarshani	Employees Provident Fund – Central Bank of Sri Lanka	2014.03.05	workshop on Submission of Employers Contribution Details Through Electronic Media
Year 2015			
Mr. R.M.D. Rathnayake Mr. P.J.Subashinhe Mr. I.M.N.P.Ilangashinghe Mr. H.H.S.Gunarathne	Prag Institute	2015.02.12	Public Property – Procedure for Losses” Damages “ Thefts & Accidents
Mr. R.K.A.P. Ramanayake	Prag Institute	2015.06.10	Disciplinary Procedure
Mr. R.M.D. Rathnayake	Prag Institute	2015.06.24	Information System Audit
Year 2016			
Mr. P.J.Subashinhe Mr. M.H.P. Darshana	Skills Development Fund LTD	2016.06.30 – 2016.07.01	Two day training of salary conversion
Mr. A.G.Rangajeewa Mr. P.J.Subashinhe Mr. M.H.P. Darshana	Prag Institute	2016.08.11	Training on Office Administration and supervision

Annex 5. Research Projects Funded by Different Agencies, 2016/2017

a. Treasury funded research projects (Rs.3.1mn)

1. Impact of thermal processing on total antioxidant capacity and lycopene bio-accessibility of tomato juice.
2. Quality improvement of spices using ozone sterilization.
3. Estimation of heavy metal contamination in some popular vegetables
4. Cryogenic size reduction of chilli grown in different districts of Sri Lanka
5. Evaluating the effect of fruit coating on the shelf life extension of lime under different storage conditions
6. Evaluation of the effect of low temperature storage conditions on locally available economically important vegetables
7. Study on wet drying of paddy under emergency conditions
8. Determination of postharvest weight loss and quality deterioration of paddy during on-farm storage
9. Infrared application in rice processing industry
10. Developing of technology for cleaning and de-stoning of agriculture commodities.

b. Ministry funded research projects (Rs. 2.4 mn)

1. Preharvest and postharvest disease management of green chillies using rice husk silicon as an alternative strategy for synthetic fungicides.
2. Ensuring the safety of edible oil used in the food industry by developing methodology to detect and quantify polymer migration from plastic bottles.

c. Research projects funded under NRC and NSF grants (Rs. 3.4 mn)

1. Investigations of fruit phenology and pre-harvest foliar treatment of growth regulator on fruit quality and postharvest life of lime (*Citrus aurantifolia*Swingle)
2. Development of postharvest treatments and storage strategies for enhancement of postharvest life of lime (*Citrus aurantifolia*Swingle)

d. Public – Public partnership research projects.

1. Evaluation of continuous paddy par boiling equipment (online cooker) for its performance (Rayin Agroma (Pvt) Ltd
2. Development and optimization of medium scale rice flour noodle process, Amila Industries
3. Development of a fruit jelly and self-life determination under different storage conditions, Serendib Flora (Pvt) Ltd
4. Development and quality evaluation of garlic based curry mix to utilize preservative effect of different Sri Lanka spices, Pannilnt
5. Development of medium rice flour shifter, Dasa Iron Works

Development Projects – 2016

1. Improvement of supply and value chain management of mango (Started in 2016, budget Rs. 25.9 mn
2. Training of trainers (TOT) on postharvest loss reduction of agricultural food crops in major agricultural institutions in Sri Lanka mango (Started in 2016, budget Rs. 1.0 mn
3. Introduction of fruit ripening by organic methods(Started in 2016, budget Rs. 5.425 mn
4. Management of supply and value chain of agricultural products in Sri Lanka (Rs. 1055 mn)
5. Determination of heavy metal contaminants of economically important food crops (s. 5.35 mn)
6. Improvement and supply and value chain management practices of banana (Rs.%65 mn)
7. Improvement supply and value chain management practices of guava (Rs. 8.94 mn)
8. Improvement supply and value chain management practices of papaya (Rs. 5.17 mn)

Development projects, continuing from 2016/2017

1. Improvement supply and value chain management practices of mango in Sri Lanka
2. Training of trainers on postharvest loss reduction of agricultural food
3. Introduction of fruit ripening by organic methods

