

External Review of the Research and Development Aspects of the Department of National Botanic Gardens of Sri Lanka

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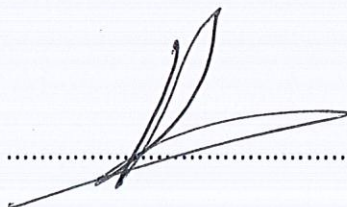
Sri Lanka Council for Agriculture Research Policy

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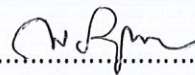
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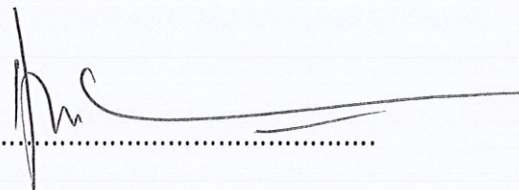


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CHAPTER ONE

Introduction

1.1 Historical Background

The National Botanic Gardens of Sri Lanka have been established during the early 19th century. It is well known all over the world and acknowledged nationally and internationally as a centre of excellence for collection, conservation and study of flora particularly that are tropical and endemic to the region of South East Asia. It is presently visited by both local and foreign visitors annually exceeding two million. The Royal Botanic Garden at Peradeniya, Botanic Garden at Hakgala and Botanic Garden at Henarathgoda were established by the British in the years 1821, 1861 and 1876, respectively. The Hakgala garden was established as a nursery for cinchona plantation and subsequently for introduction of tea plantations and Gampaha for cultivation and promotion of rubber in Sri Lanka. Activities of the Botanic Gardens resulted in emergence of important state Departments such as Forest in 1887 and Agriculture in 1912 as well as institutions of plantation crops namely Rubber Research Institute in 1909 and Tea Research Institute in 1925. After the establishment of Department of Agriculture (DOA), the administration of Botanic Gardens came under the purview of DOA. The Botanic Garden at Ganewatta, in Kurunegala district was established in 1950s for medicinal plants collection and conservation.

In 2006, the Botanic Gardens was separated from the DOA and established as a separate and independent department which has been named as the Department of National Botanic Gardens (DNBG) by a Parliament Act. Since then two new Botanical Gardens, one at Mirijiwela, in Hambantota district as the Dry Zone Botanic Gardens (DZBG) and the other at Seethawaka in Rathnapura district as the Wet Zone Botanic Gardens (WZBG) were established under the guidance of local experts in 2013 and 2015, respectively as a national need for ex-situ conservation of Dry Zone plants and Low Land Wet Zone plants while developing floriculture/herbal industry and ecotourism. Infrastructural facilities of the Botanic Gardens system are well fitting for the establishment of floriculture/herbal industry and ecotourism.

1.2 Vision, mission and objectives of DNBG

1.2.1 Vision

To become scientifically and aesthetically finest Botanic Gardens in the Tropics, while conserving plants and contributing to the economic growth of Sri Lanka.

1.2.2 Mission

To provide opportunities for the public to study, sustainably conserve and admire plant resources in natural and manmade environments.

1.2.3 Objectives OF DNBG

- Planning and implementation of *ex situ* conservation strategies for the conservation of Sri Lankan plants.
- Authentication and identifying any plant or plant material for legal, scientific, commercial and educational purposes as well as to initiate and conduct research and perfect techniques for authentic identification of plants and plant materials.
- Collecting of preserving type specimens of dry and/ preserved samples and relevant data of all native plants at the National Herbarium for authentication as well as regular monitoring of plants in their native habitats as well as under *ex-situ* conservation at gardens.
- Disseminate authentic information and technical expertise on plants and plant related industries of Sri Lanka using educational and communicational industries.
- Conduct diverse research and implement technologies to develop the floriculture industry in Sri Lanka.
- Conservation, protection, management and development of National Botanic Gardens at high standards.
- Establish new Botanic Gardens at appropriate places.
- Providing for the use of the Botanic Gardens for public recreation and tourism.
- Plan and implement research and technical programs needed to popularize amenity Horticulture (Floriculture) in Sri Lanka.
- Provide technical advice to conserve Sri Lankan plants of historic importance including maintaining the health of the sacred Bo-Tree at Anuradhapura.

CHAPTER TWO

The Review

2.1 The Review Team

The review team is comprised of three members namely Dr. Sumith Abeysiriwardena (An expert in the field of Agriculture Research as chairperson of the review panel), Dr. Nimal Dissanayake (Another expert in the field of Agriculture Research) and Mr. Rizvi Zaheed. (An expert in agriculture from the private sector).

2.2 The Sources of Information

Sources of information provided for the review were presentation made by the Director General of DNBG, Brief report on DNBG submitted to CARP by DG/ DNBG for the external review, the National Botanic Garden Act, Annual performance report of DNBG for the year 2018, discussions and consultations with flower growers, exporters and other stake holders facilitated by SLCARP, visits made to Royal Botanic Garden, Peradeniya and Dry Zone Botanic Garden, Mirijjawila and discussions and consultation of different categories of staff of those institutes.

2.3 The Objectives of the Review

No formal performance review has been done about the status of DNBG since its establishment in 2006 and this is the first review which is particularly focusing on Research and Development (R&D) aspects of DNBG. R&D basically includes technology generation and transfer. Generation of new technology is the back bone of development in any sector. However, outcome and impact of newly generated technology can be achieved only if it is effectively transferred to stakeholders or end users. As R&D of an institution cannot function in isolation other areas that are important and supporting to R&D in DNBG are also looked into as necessary.

Though the DNBG is coming under the Ministry of Environment and Forestry, the policies and directive of SLCARP and its relevant Ministry of Agriculture are well accepting the appropriateness of DNBG's Mission in production and product development with respect to collection, identification, conservation, preservation, multiplication, distribution of flora and maintenance of Botanical Gardens including floriculture as R&D is involved in all these activities.

DNBG is qualified to receive CARP funding for R&D as CARP is the main funding agency for agricultural research in Sri Lanka and R&D in Floriculture which is coming under Agriculture is one of the mandate of DNBG. However, there are other areas such as plant propagation, agronomic practices for maintenance and productivity improvement including control of weeds, pests and diseases of important plants etc. where CARP funding for R&D is justifiable.

2.4 The Terms of Reference of the Review

The review has been based on the Terms of Reference (TOR) provided to the review team by Sri Lanka Council for Agriculture Research Policy (SLCARP) (Annex 1). Review report is prepared in response to the order of the areas to be reviewed as indicated in the TOR.

2.4.1 Assessing the quality, cost effectiveness, relevance and impact of the Scientific Programs carried out by DNBG in order to ensure that Government Funds are being effectively utilized to address the sector needs

2.4.1.1 Maintenance of residential gardens

Maintenance of residential gardens of H. E. the president and Hon. Prime Minister and commonwealth War Graves should be excluded from the DNBG activities. Allocation of both human and physical resources of DNBG for such activities is really a wastage in relation to DNBG's mandate where maintenance of those gardens could be well done by qualified gardeners. All the other scientific programs carried out by DNBG appear cost effective, relevant and making a big impact with high quality ensuring that government funds are being effectively utilized to address the sector needs.

2.4.1.2 Conservation of the natural resources, impact of Institutions practices on natural environment and long-term environmental sustainability

DNBG is very efficiently and effectively conserving natural plant resources. All these conservations are ex-situ in Botanical Gardens established in different climatic zones. Royal Botanical Garden at Peradeniya in the Mid Country Wet Zone is having about 4,500 plant species, Botanic Garden at Hakgala in the Up Country Wet Zone is having about 1000 plant species, Botanic Garden at Henerathgoda in the Low Country Wet Zone is having about 2000 plant species, Medicinal Plant Garden at Ganewatta in the Low Country Intermediate Zone is having about 100 medicinal plant species, Dry Zone Botanic Garden at Mirijawila in the Low Country Dry Zone is having about 650 species of dry and arid zone plants and the Botanic Garden at Sithawaka in the Low Country Wet Zone is having 200 plant species under ex-situ conservation. Almost all the endemic, introduced and rare plants are conserved and effectively maintained in these Botanical Gardens and this is really commendable, appreciable and should be appropriately rewarded.

DNBG is also involved in in-situ conservation of endemic plant species only when necessary by multiplying and planting endangered plant species in their natural habitats but not as much as they do for ex-situ conservation. Sole authority and responsibility of protecting, maintaining and if necessary multiplying through tissue culture of historically sacred Sri Maha Bodhi, the recorded oldest tree in the world, at Anuradhapura lies with the DNBG. It is learnt during the review work that the protection and conservation of Mangrove environment is also being

planned in future activities. Species facing extinction are recovered through re-introduction for in-situ conservation after ex-situ conservation in Botanic Gardens.

Maintenance of National Herbarium at NBG, Peradeniya where over 170,000 dried herbarium specimens are conserved at appropriate storage conditions for reference purposes is highly commendable and very useful. About 3,500 books, periodicals and a historical collection of botanical illustrations related to Sri Lanka's native flora are found in this Herbarium.

Preparation of the National Red List of Sri Lanka in 2012 is another activity of the DNBG, which should be highly rewarded. According to the National Red List, the number of flowering plants extinct was 5 and endangered, vulnerable and threatened were 1912 and data deficient on 142 plants and number of ferns endangered, vulnerable and threatened were 261 and data deficient on 12 ferns.

Studies on biodiversity of flora in Sri Lanka are also conducted by DNBG. Within flowering plant diversity, number of plant species identified is about 3156, number of endemic species identified is about 894 and number of threatened plants identified is about 1383. In addition, within lower plant diversity, 336 ferns, 561 mosses, 303 liverworts and more than 1000 lichens have been identified.

All the above activities are making a big impact on preserving biodiversity and long-term environmental sustainability.

2.4.1.3 The Institution's mandate and its criteria for allocation of resources and planning procedures adopted by the institution and the mechanisms for their formulation

2.4.1.3.1 Human Resources

Cadre positions and numbers are decided by the management of the DNBG based on the demand in different levels and divisions depending on the mission and the objectives of DNBG. However, government procedures are adopted to approve and filling vacancies of cadre positions.

At the moment approved number of cadre positions at senior level which includes Research Officers is 34 and Tertiary level is 09 and they are not adequate for effective functioning of DNBG considering the huge mandate given to it. In addition, presently there are even vacancies within already approved all cadre levels; senior level-8, Tertiary level- 6, Secondary level – 42 and Primary level – 184 amounting to total of 252. Whatever the number of vacancies, they have to be filled adopting government procedures though they are highly inefficient, outdate and politically bias. However, recruitment of staff is an urgent need to overcome major constraint of dearth of staff for the efficient fulfilment of DNBG's objectives.

2.4.1.3.2 Financial Resources

Financial resources are allocated on yearly basis by the line ministry based on the request made by the DG of DNBG. However, there are no constraints regarding financial resources which is accommodated in budgetary allocations. Financial need for development activities, R&D and services rendered by DNBG is decided by the management of DNBG after making several discussions with participation of DNBG staff at different levels.

Quarterly Audit Committee meetings and monthly meetings are conducted to review the financial progress and other relevant issues. Procurement meetings are also conducted for purchasing and construction activities at different levels. Budget is in line with the DNBG policies and plans and made to utilize resources effectively. Nature of the budgetary review and evaluation processes and the involvement of important stakeholders in the above stability of funding are not clear. The relationships between budget, DNBG policies and planes and the effectiveness of utilization of resources are appropriate and appreciable.

The total financial allocation for the year 2018 was Rs. 810.2 million out of which capital and recurrent allocations were Rs. 222.7 and 412.51 million, respectively. In addition to capital and recurrent, the DNBG has a very specific source of funding identified as Botanic Garden Trust Fund (BTF) which consists of not more than 25% of ticket sales for visitors to the Botanic Gardens. This was Rs. 175 million for the year 2018 and was about 22% of the total of Rs. 784.77 million revenue from visitors to all Botanic Gardens.

2.4.1.4 The institution's rationale for its present allocation of resources among research, extension, information exchange and other activities

The research (R) and technology transfer (TT) is treated as one unit so that the resources are allocated for the whole unit and BTF is mostly used for funding R and TT and other relevant scientific activities. There is no set rationale for distribution of resources among R and TT. However, distribution of resources among R and TT appears to be need based.

The human resources allocated to R & TT are handling both R & TT and also other services as the need arise. This procedure appears not very efficient and effective. With respect to financial resources, allocation for Research appeared much less than 0.1% out of the total allocation for the DNBG. This shows the level of attention given to research. However, Small scale external funding has also been received for research through Ministry of environment.

2.4.1.5 Management of the scientific programs and financial resources of the institution and the coordination of its activities

Government procedures and rules and regulations are adopted in managing scientific programs and financial resources and their coordination among finance, administration and technical divisions. Quarterly audit meetings and monthly progress review meetings headed by the DG of DNBG are conducted to review the progress of financial management and other relevant issues. Procurement committees comprising officers from financial, administration and technical divisions are also functional for purchasing and supplying inputs for scientific programs.

In general, financial progress is highly satisfactory and presumably physical progress as well. For example, financial progress was 97% of the total allocation of Rs. 810.21 million for the year 2018.

2.4.1.6 Level of national and international recognition of the institution and its scientific staff

Level of national and international recognition of the institute is very high and commendable as it has a long and proud history, it is maintained to the highest international standards, it is visited by about 2 million local and foreign people annually, it has become a major tourist attraction in Sri Lanka and it is having memorial collection of trees planted by various eminent persons including many heads of states around the world and foreign and local dignitaries. In addition, several awards have been won by DNBG from the Ministry of Science and Technology as well as the Ministry of Tourism. National Research Council Merit Award for scientific publications and NSF Research Award in 2017 for a project on growth responses of Silver dragon or Mondo grass have also been won by DNBG.

The available scientific staff is locally and internationally recognised for their educational qualification and contribution in scientific programs. However, qualified staff is not adequate to fulfil the critical mass for conducting important scientific programs in order to achieve expected level of such recognition. In addition, strengthening collaboration with universities and regional and international research organizations and training scientific staff in internationally recognized universities/research organizations will definitely further improve and enhance the recognition of the institution and its scientific staff.

2.4.1.7 Cooperation/collaboration with universities, regional and international research organizations.

There is no strong product and product development oriented collaboration of DNBG with local and international research institutions and universities with respect to R & D except conducting ad-hoc research projects with students in relation to internship of students. In addition, DNBG has the opportunity to get research grants from Botanic Gardens Conservation International (BGCI) but such records of relevant research projects and their outputs are not visible. However, several grants have been obtained from SLCARP and National Science Foundation (NSF) for research in the past.

2.4.1.8 Competency and professionalism of the Directorate and the senior management of DNBG and the definition of the roles, organization and quality of the leadership of DNBG and rapport with the staff

The directorate of the DNBG consists of Director General and Director (Dev.), Director (R & TT), Director (Admin.), Chief Accountant and Internal Auditor coming under the Director General. There are two Deputy Directors viz. Deputy Director (National Herbarium) and Deputy Director (Floriculture R & D) coming under Director R & TT. Although the present Directorate and the senior management of DNBG is needed to be re-structured and re-organized for efficient and effective services, competency and professionalism of present well qualified and experienced Directorate and the senior management and their roles and quality of the leadership are well accepted. However, rapport of the senior management with the staff has to be improved.

2.4.1.9 Procedure for determining staff requirement at all levels of selection, evaluation and compensation of staff

DNBG is a public sector Department in Sri Lanka and therefore, it is strictly compelled to adopt government procedures, rules and regulations for determining staff requirement at all levels of selection, evaluation and compensation of staff.

2.4.1.10 Administrative of fiscal, purchasing and supply, personal computers, housing and other facilities including transport and general management services and their effectiveness in supporting the scientific staff

All the above aspects are in operation. However, they are not as efficient and effective as expected and therefore, the scientific staff is most of the time frustrated. This is a common problem in Sri Lanka where scientific and technical staff is not well recognized and treated commensurable to the level they deserve.

2.4.2 The appropriateness of DNBG research agenda to meet the emerging challenges in the future and in particular in meeting with 2030 sustainable developmental goals and also national targets related to DNBG

2.4.2.1 Research and Development focuses on immediate and long term needs in Sri Lanka

No focused R & D program on immediate and long term needs in Floristic and Floriculture aspects is in record except some ad-hoc research studies conducted and no roles of various scientific disciplines in relation to R & D program have been identified. However, plant breeding programs are carried out particularly for native plants, orchids and anthuriums in order to develop new varieties with desirable agronomic or botanical traits. Thus, development of a systematic national research program focusing on short and long term research needs covering important flora of diverse ecological and climatic zones indicating roles of different scientific disciplines including both Floristic and Floriculture aspects is urgently needed. Addressing current and future floristic and floriculture issues are research priorities of DNBG.

Floristic research is related to updating and improving knowledge of plant diversity, plant identification and authentication, in-situ and ex-situ conservation of plants, sustainable utilization of plant species with economical potential and restore species habitats. In Floristic research, Red Data Book is considered as a basis for future plant exploration research. Other factors such as endemism and threat level of a given plant species, loss of genus, family as well as habitats, natural disasters and requests by professional scientists are also considered. Furthermore, application of modern cutting edge technology such as molecular techniques for plant identification and authentication are also considered.

Floriculture research that initiated in 1950 is related to the development of Floriculture industry in the country. Although, Sri Lanka was in the 9th place of the world rank of Floriculture industry in the 1990's, as of 2015 Sri Lanka has dropped to 47th place. DNBG is the main institution (department) mandated towards the development of the floriculture sector in the country. Thus DNBG has to play the major role in the Floriculture industry in the country by exploration and introduction of new varieties using potential wild species, improving desirable agronomic traits, maintenance and mass propagation of these newly discovered plants, development of new varieties through conventional and mutation breeding, improving pest and disease management, improving post- harvest technology, identification of aquatic plants with floriculture potential and high value flowers and development of natural products from native plants and entophytic fungi.

2.4.2.2 The results of research during the last five years and their practical applicability and economic feasibility including the impact of relevant sector

Although all the research findings have not been published, research findings that have been published appear adequate. During the last five years, about 100 research papers have been published mostly by presenting in National and International conferences and symposia and most of these papers have emerged from the ad-hoc studies conducted by university under graduate students under the supervision of DNBG staff members or University staff.

Although the number of papers published appears adequate in numbers considering the lack of adequate relevant technical staff, most of research publications are not market and result oriented focusing on a sound research program. Each and every paper is leading to some sort of research finding or output but their practical applicability, economic feasibility and finally the outcome and potential impact on the country's economy are very limited mainly because they are ad-hoc but not target oriented studies in a focused research program.

2.4.3 All the aspects of DNBG's functions directed towards Research and Development, Dissemination of technology through extension and services offered to its stakeholders and its impact and usefulness to address the timely needs

2.4.3.1 The adequacy of research support and facilities

Presently available qualified and experienced scientists are limited to undertake advance research and support and facilities for research are highly limited for a sound research program. Present Infrastructure facilities and human and financial resources for research are highly inadequate as research is treated very lightly. However, research facilities at the National Herbarium are being upgraded at present. Even the main role of scientific officers who are engaged in research is something else either providing services or managing the system. As R & TT is treated as one unit coming under one director, research is always given comparatively less priority than TT as TT is a service that directly involves with the stakeholders.

Floriculture units have already been established in Botanic Gardens at Henarathgoda, Mirijjwela and Awissawella. Laboratories with tissue culture facilities are already available at these units. Each of these units is to be placed under an Assistant Director. In the future, these are expected to be upgraded as research units and further to be developed with research facilities. Planning to establish a seed bank and research unit at the Botanic Garden Hakgala is appreciated as very few research programs are being presently conducted by the DNBG for Up-country flowers.

Building of a Research Centre at the Dry Zone Batanic Garden, Mirijjwella which is planned to be operated within a few months is appreciated. By 2012, DNBG spearheaded a program to enhance the cultivation of Cut greens/Cut foliage and 143 acres of new cultivations of *D. Sanderiana* was initiated under this program.

2.4.3.2 The recorded and potential outcome and impact of DNBG's research

This is not clear as there was no proper Research program in DNBG. Although, DNBG has released 66 new good Anthurium varieties, 06 Orchids varieties and one Chirita variety to date, their outcome and impact are not clear. However, these varieties have been sent to overseas auctions and they have been accepted internationally. Some of them are presently cultivated in Sri Lanka.

Flower growing on a commercial basis in Sri Lanka became popular only in the 1990's with local sales and exports and Floriculture as a separate unit was formed by the DNBG only in 2004. Anthuriums, cultivated Orchids and most other flowers were neither available nor seen in Sri Lanka before 1970. Commercial flower cultivation was introduced in Sri Lanka in the early 1980's only after a German project initiated by the Botanic Gardens. However, the impact of DNBG's TT service should be appreciated but it should not be mistaken with that of Research.

Only after the 1990's the DNBG introduced growing under shade, poly tunnel/protected cultivation, glass house and use of mixed fertilizers, slow release fertilizers as well as other growing techniques that are practiced by all flower growers at present. A method of mass production through tissue culture has been developed for Anthuriums, Ferns, African violet, Orchids and for several aquatic plants. All fertilizer recommendations for ornamental plants and flowers are provided with the fertilizer secretariat and all mixed fertilizers imported to Sri Lanka for floricultural crops are recommended by the DNBG. In addition, new flower types have been introduced and planting materials of those flower types have been provided with flower growers by the Botanic Garden over the years for commercial cultivation. High quality planting materials of new and improved varieties have been imported from Netherlands, Israel and India for distribution among flower growers at the cost price. Growing techniques for these varieties have also been perfected by DNBG. Thus with a comparatively more financial inputs as well as addition of human resources pioneering work done by DNBG can be strengthened and further enhanced.

2.4.3.3 Cooperation with other research institutes and with national development programs, private sector organizations and other stake holders

DNBG is cooperating with other public sector organizations, private sector organizations and NGOs for conservation, maintenance, identification, utilization and authentication of plants in respect of providing services and technology transfer. DNBG collaborates with the National Plant Quarantine Service of the DOA when issuing import permits and DOA when preparing standards for imported flowers and standards for seed and planting material certification. Relevant technical staff of DOA, Forest Department and Department of Wildlife are trained By DNBG.

DNBG is presently cooperating and collaborating with universities, international research centres and private sector industries for research. This activity is very weak as DNBG has no sound research program and it is restricted to ad-hoc short term studies of internship students.

2.4.3.4 Mechanism adopted to get the feedback of stakeholders on research outputs and then planning future R&D

Feedback on research issues and outputs is getting from stakeholders through meetings and discussions with them and nursery visits conducted by extension officers. Literature surveys and personal comments from experienced professionals are also used to get feedback.

2.4.3.5 Constitution of research committees of the board

There is no such formal Research Advisory or Sub-committee at DNBG. Decisions regarding R&D are taken by DG after discussing with the director R & TT and relevant research officers. The composition of the board of Management does not provide adequate strength for Research component of the DNBG and therefore, appointment of an Advisory Board for effective planning and implementing of a national research program of DNBG is an immediate requirement.

2.4.3.6 Transferring technological recommendations/research outcomes to relevant stakeholders and the information exchange and extension programs and the participation of the research staff therein

Several extension programs have been adopted to transfer technological recommendations/research outcomes to relevant stakeholders and for the information exchange;

National Symposium on Floriculture research is annually conducted by the Floriculture Research and Development unit of DNBG in collaboration with CARP. At this symposium relevant research papers and posters are presented by the officers of DNBG, various other departments, institutions and universities. Most of these research papers are addressing the sector needs so that they are demand driven and discussions are made by researchers and clients in relation to relevant issues in the floriculture sector.

An annual newsletter with articles related to development of the Floriculture sector is published and distributed among growers and other related organizations. Leaflets on various topics of floriculture related to over 30 plants have been made available.

Regular stakeholders meetings are conducted with scientists, naturalists, environmentalists and staff of DNBG for preparation of the National Red Data Book and for updating its information.

Workshops and training sessions related to floristic research are also conducted on plant taxonomy, biodiversity, data base management etc. with local and international resource persons. Officers of DNBG are also publishing their research findings in various national and international forums.

A program named 'Suwahas Mal' initiated in 2005 is continuously conducted by DNBG to provide extension services as well as to assist small and medium scale flower growers. Under this program DNBG is organizing growers' associations, providing technical advice/planting material and necessary items for infrastructure development and assisting in marketing growers products.

With respect to information exchange in the Floristic field, several books viz. Moss Flora in Central Hills of Sri Lanka in 2015, Beautiful Wild Flowers of Sri Lanka in 2015, Common Way Side Trees of Sri Lanka, A collection of Botanical Illustrations – Paintings by the De Alwis family – Volume 2 (2018) have been published.

2.4.3.7 Effectiveness of the extension in the relevant sector

'Suwahas Mal' extension program has been started with about 80 flower growers associations in 12 districts of 4 provinces in 2005. At present, there are over 200 societies across all 25 districts of the country with a membership of nearly 8500 and over 10,000 individuals have been trained, over 5000 nurseries have been visited by extension officers of DNBG and over 850 exhibitions and plant sales have been organized.

Demand for training programs in Floriculture is in an increasing trend and a total of approximately 25,000 individuals are trained in all Botanic Gardens annually.

Although, Floriculture was a small segment in Agriculture in Sri Lanka few decades ago, now it has become a fast growing industry that caters for local and international markets. DNBG initiated commercial floriculture in the early 1970s at a small scale and now it has become a thriving industry providing employment and promoting income generation particularly among women. DNBG has provided over Rs. 76 million worth of shade materials, GI pipes and planting materials to initiation of *D. Sanderiyana* cultivations to nearly 175 growers in the Gampaha, Kegalle and Colombo districts.

2.4.3.8 Services provided by DNBG such as Consultancy and advisory services/training, laboratory and extension services

Services related to collection, identification, ex-situ and in-situ conservation, authentication of plants, relaxation and amenity purposes and habitat restoration and landscape beautification provided by DNBG appear highly satisfactory in general. In addition, training courses viz. landscape assistant course at NVQ 3 & 4 levels, 3 months certificate course and several other short courses conducted by the School of Floriculture and Landscape Gardening should also be appreciated.

Services related to Floriculture are not provided to the level expected because there is no sound and clear program on Floriculture Research and Development and the necessary collaboration with other relevant Departments and Institutions on such research. With respect to Floriculture industry, DNBG should help flower exporters in quarantine and custom clearance activities in collaboration with respective departments. In addition, DNBG should provide soil testing facility for flower growers. A new laboratory facility is being developed at a cost of more than Rs.100 million for use of modern molecular techniques mainly for plant identification, classification and authentication.

2.4.3.9 Identification of problems and constraints impending the extension programs/dissemination of technological recommendations to the stakeholders

The main limitation is inadequate staff grade officers. Only 26 such officers are available out of which 12 are newly recruited and they have to look after administrative and financial matters in addition to their main involvement in scientific and technical activities.

Adequate relevant advanced technology is not available particularly in the field of Floriculture for transfer.

2.4.3.10 To identify any deficiency in the procedures adopted by DNBG in recognizing the research needs in the particular sector

DNBG research strategy and priorities are formulated by DG after discussing with the director R & TT and relevant research and extension officers. Each of them is playing a significant role in this aspect as they are educationally qualified with practical experience. However, this appears not very effective as there is no direct involvement of stakeholders and external expertise. Thus, there is an immediate need to appoint a research committee comprising all the above indicated individuals for the formulation of DNBGs research strategy.

Stakeholder needs and feedbacks are obtained during meeting with growers and officers from other relevant institutes and universities. Field visits to nurseries of growers are also utilized in formulation of research plans. However, direct involvement of stakeholders and external expertise in this respect is necessary. In addition, collaboration with other research institutes and with national development programs and private sector organizations should also be strengthened.

2.4.4 Advices on effective planning and implementing on future programs of DNBG

2.4.4.1 Vision and Mission need to be revisited

Current vision: To become scientifically and aesthetically finest Botanic Gardens in the Tropics, while conserving plants and contributing to the economic growth of Sri Lanka.

Suggested vision: To become scientifically and aesthetically finest Botanic Gardens in the Tropics, while conserving and authenticating plants and contributing to the economic growth of Sri Lanka.

Current mission: To provide opportunities for the public to study, sustainably conserve and admire plant resources in natural and manmade environments.

Suggested mission: Exploration, sustainable conservation and identification of plant resources and development of the floriculture industry while facilitating ecotourism to provide opportunities for the public to admire plant resources in natural and manmade environments and to utilize them.

2.4.4.2 Line Ministry

DNBG has been placed under various ministries in time to time since it was established in the year 2006. This has hampered in making long term development programs, recruitment of necessary staff and providing trainings particularly overseas training for the scientific staff. Presently it is coming under the proper ministry of Forestry and Environment, which should not be changed in the near future.

2.4.4.3 Maintenance of residential gardens

Maintenancé of residential gardens of H. E. the president and Hon. Prime Minister and commonwealth War Graves are not included in the objectives of DNBG so that it should not be handled by DNBG.

2.4.4.4 Recognition of Scientific staff

One of the common problems in Sri Lanka is that scientific and technical staffs are not well recognised and treated to the level they deserve. The measures that can be adopted at DG/DNBG level to recognise the scientific staff have to be identified and adopted for encouraging dedication of staff.

It is learnt that staff training is minimal. Therefore, national and international training opportunities should be explored and adequate funding for training should be provided by budgetary allocations. Considerable amount of BG Trust fund may be used for this purpose.

2.4.4.5 Enhancing research

Research involvement in Floristic and Floriculture aspects has to be enhanced in order to make a significant impact on the country's economy.

It is proposed to enhance research on activities related to National Herbarium, Biodiversity in flora and preparation of the National Red List of Sri Lanka.

With respect to Floriculture, we propose to enhance research on export oriented flower plants like Sandriyana and to have a model Floriculture research unit at Henarathgoda Botanical Garden, Gampaha.

2.4.4.6 Staff recruitment and promotions

Recruitment of staff at all levels is an urgent need to overcome major constraint of dearth of staff for the efficient fulfilment of NDBG's objectives. Due promotions should be given to officers in time. We have observed that there are some highly skilled labourers with long years of experience, who are frustrated due to poor remuneration and recognition. Similarly, there are officers with post graduate qualification and long years of service but not promoted to acceptable positions. They are really an invaluable human resource to the DNBG. We propose them to be promoted to the highest level possible with an increase in salary.

2.4.4.7 Restructuring of Research (R) and Technology Transfer (TT) Division

As R & TT is treated as one unit coming under one director, research is always given comparatively less priority and TT is always given high priority as TT is a short term service that directly involves with the stakeholders. Therefore, measures should be undertaken to establish a dedicated research division under a director position so that vast and diverse range of productive research programs can be undertaken with collaboration of many other relevant government institutions, universities and private sector institutions. Thus, a structural change to have a separate division for research including important disciplines such as Plant Taxonomy, Plant Systematics, Plant Conservation and Reproductive Biology, Crop Improvement, Agronomy, Crop Protection, Post-harvest Technology etc. with necessary facilities and qualified human resources at DNBG is strongly recommended. Research division should come under the Director (Research) which would be a new position. Under the Director (Research) there may be two Deputy Directors; Deputy Director (Research) Floristic and Deputy Director (Research) Floriculture.

It is learnt during the discussion with DG/DNBG that few new officers have been recently recruited to the DNBG and currently undergoing a basic training at Sri Lanka Institute of Development Administration (SLIDA). After this initial training, these officers may be identified to place under plant science disciplines indicated above paying attention to their basic

qualifications. For example Plant Taxonomy has to be headed by individuals with Botany special degree while Agronomy has to be headed by individuals with a degree in Agriculture. Plant pathology and entomology may be headed by agriculture, botany or zoology degree holders as the case may be.

Similarly, another division for Technology Transfer (TT) is required under the Director (TT), to undertake technology transfer activities.

2.4.4.8 Distribution of resources between R & TT

There should be a rationale for distribution of resources among R and TT. As research is the backbone of development, total funding for both R and TT (excluding salaries) should be distributed in the ratio of 70% for R and 30% for TT. However, the human resources should be distributed among R and TT the other way round allocating 70% for TT and 30% for R as comparatively more human resources are needed for TT than that of R. Research staff has to be highly qualified with relevant post-graduate degrees preferably at PhD level.

Presently, a proportion not exceeding 25% of tickets sale for visitors to the Botanic Gardens is allocated for research and other scientific activities. It should be utilized maximally and spent mainly on research.

2.4.4.9 Research agenda

Sri Lanka is very proud of her possession of rich biodiversity of which fauna and flora is a major component. The DNBG is the key institution which has the authority for identification, conservation, authenticating and utilization of flora of Sri Lanka which is a very important national and natural resource. Conservation alone is not meaningful if this natural plant resource is not scientifically identified, assessed and utilized for economic development of Sri Lanka. For sustainable and profitable utilization of this resource need a well formulated research agenda.

DNBG has no sound research agenda. Current process of identifying research problems and setting research priorities are based on issues of flower and ornamental growers, issues identified during nursery visits, observations made at field excursions, literature surveys, informal Personal comments from experienced professionals and Informal requests by Professional scientists. In addition, implementation of research program is mostly restricted to projects of the internship students at present.

There is no national Floriculture research program identified in the activities of DNBG. Therefore, there is a strong and urgent need to formulate a national Floriculture research program which covers the mandate functions of DNBG specified in the objectives of establishing DNBG Act and market oriented breeding and improvement of floriculture leading to disease free planting material and other plant products for local and export markets.

Development of a systematic national research program focusing on short and long term research needs indicating roles of different scientific disciplines covering both Floristic and Floriculture aspects is urgently needed.

2.4.4.10 Formulation of sound Research agenda

As seen in the brief report of DG/DNBG the procedure of formulating the research agenda is not strong enough. Therefore, an effective annual procedure is proposed to strengthen the research program of DNBG to uplift the DNBG as a National Center for Plant Resources.

Annual event for consultation for expert opinion of competent scientists for development of effective and meaningful research agenda for DNBG is also proposed.

Research proposals on well prepared templates are to be entertained from suitably experienced and qualified plant scientists on nationally identified subject areas of interest to DNBG mandate through News Paper Advertisements. Some of the areas for clarification are given below;

Ecological and environmental issues related to flora of Sri Lanka

Conservation of endangered plant species in-situ or ex-situ with public participation.

Management of introduced plant species,

Development of commercial varieties through mutation/ hybridization

Scientific study of indigenous medicinal plants for economic benefits

Extraction of natural products from plants on line with modern trends of healthy living

Management of invasive plant species for protection of natural ecosystems

Utilization of plant species for amelioration of urban air pollution

The present composition of the Board of Management does not provide adequate strength for Research component of the DNBG. Therefore, appointment of an Advisory Board for effective planning and implementing a national research program of DNBG is an immediate requirement. National research program for short term and long term may be formulated by an eminent and experienced research team with proven records of research accomplishments and publications consisting relevant disciplines and relevant institutions such as Dept. of wild life, Dept. of Forest, Universities etc. through workshops organized by DNBG with direct involvement of stakeholders. The CARP may facilitate such activities. Research areas have to be identified on regional basis as wet zone, dry zone, up country, mid country and plant species must be identified on priority basis. Present trends and emerging needs of export sector and marketing

opportunities must be taken into consideration in formulating short and long term research projects.

An Advisory Board may be appointed with following composition chaired by DG/ DNBG for a period of 3 years funded by DNBG Trust Fund.

Specialties of the Advisory Board:

- Systematic Botany/ Taxonomy
- Plant Molecular Biology
- Plant Breeding and Genetics
- Plant Pathology
- Entomology
- Plant Physiology
- Agronomy
- Biochemistry/ Natural Products specialist
- Horticulture

Proposed advisory members should be with PhD qualification in relevant disciplines with 10 years of experience after post graduate qualification and proven track record of scientific publications and research accomplishments.

Since there are no enough officers at present at DNBG system, based on the identified research agenda, specific and detailed research projects proposals may be entertained from suitably qualified scientists (in service and retired) with payment of an honorarium advertised in national newspapers giving wide publicity. DNBG Trust Fund can be made use for this purpose.

Once research projects are identified they may be carried out in collaboration with PGIA, PGIS, various faculties of science and agriculture in Universities Island wide as the case may be depending on regional and ecological situations. Scholarship program may be formulated to fund post graduate students in floriculture so that best students for post graduate studies may be attracted. All the research projects should be related to DNBGs research program and they should also be result oriented.

2.4.4.11 Cooperation with other research institutions

Cooperation with other research institutions and with national development programs, private sector organizations and other stake holders should be strengthened. The functions of DNBG identified in the Part 111 General of the Act cannot be done in isolation by DNBG alone without the collaboration of institutions such as Dept. of Wildlife, Dept. of Forest, Dept. of Agriculture especially with quarantine functions. Therefore, an objective must be identified to indicate the need for collaboration with other relevant departments for accomplishing the functions of DNBG.

Given below are some relevant institutions with which DNBG must formulate procedures for collaboration;

Forest Department

Dept. of Wildlife

Dept. of Agriculture

Ayurvedic Research Institute

Coastal Conservation Authority

National Universities: Faculty of Botany/ Plant Science

Faculty of Agriculture

Faculty of Graduate Studies

Tourist Board – Tourist hotels to promote regional/ ecological theme parks

2.4.4.12 Feedback

Services related to Floriculture are not provided to the level expected because there is no efficient feedback from the Floriculture industry on its needs. Efficient feedback for Floristic aspects is also important.

DNBG does not have many field oriented officers compared to many other Departments such as Agriculture, Agrarian Services and Irrigation. Therefore, finding the avenues of dealing with floriculture growers as well as floristic aspects is of prime importance for the development of the floriculture industry. One such an avenue available at present is the daily visitors to the DNBG so that if an opportunity is provided to visitors or interested floriculture growers to propose their suggestions, needs, problems encountered by them a feedback from island wide people representing various agro ecological zones and specific natural ecosystems may be possible with minimum expenses and effort.

Annex 1

1. To assess the quality, cost effectiveness, relevance and impact of the Scientific Programs carried out by DNBG to be reviewed in order to ensure that Government Funds are being effectively utilized to address the sector needs.
2. To look into the appropriateness of DNBG research agenda to meet the emerging challenges in the future and in particular in meeting with 2030 sustainable developmental goals and also national targets related to DNBG.
3. To look into all the aspects of DNBG's functions directed towards Research and Development, Dissemination of technology through extension and services offered to its stakeholders and its impact and usefulness to address the timely needs.
4. To identify any deficiency in the procedures adopted by DNBG in recognizing the research needs in the particular sector.
5. To give advices on effective planning and implementing on future programs of DNBG.

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External Review of the Research and Development Aspects of the Department of National Botanic Gardens of Sri Lanka

Summary Report

By

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2020- August

Coordinated

By

Sri Lanka Council for Agricultural Research Policy

Signatures of the Review Team

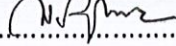
Dr. D. S. de Z. Abeyesiriwardena, Senior Consultant (R&D), CIC Agribusinesses,
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Date 21/08/2020

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Dr. Nimal Dissanayake, Director RRDI (Retired), Watapuluwa, Kandy.

Date 21/08/2020

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Mr. Rizvi Zaheed, Chairman, National Agribusiness Council.

Date 21/08/2020

Signature 

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CHAPTER ONE

1. The Review Team and Mandate

The Sri Lanka Council for Agricultural Research Policy (SLCARP) appointed a three member team to review the Research and Development aspects of the Department of National Botanic Gardens (DNBG). The review team appointed accordingly comprised;

- An expert in the field of Agriculture Research as chairperson of the review panel (Dr. Sumith Abeysiriwardena)
- Another expert in the field of Agriculture Research (Dr. Nimal Dissanayake)
- An expert in agriculture from the private sector (Mr. Rizvi Zaheed)

2. Terms of Reference (TOR)

The Terms of Reference (TOR) as set out by the SLCARP are as follows;

- Assessing the quality, cost effectiveness, relevance and impact of the Scientific Programs carried out by DNBG in order to ensure that Government Funds are being effectively utilized to address the sector needs
- Appropriateness of DNBG research agenda to meet the emerging challenges in the future and in particular in meeting with 2030 sustainable developmental goals and also national targets related to DNBG
- Aspects of DNBG's functions directed towards Research and Development, Dissemination of technology through extension and services offered to its stakeholders and their impact and usefulness to address the timely needs
- Deficiency in the procedures adopted by DNBG in recognizing the research needs in the particular sector
- Advices on effective planning and implementing on future programs of DNBG

Agriculture research is essentially for generation of new and improved technology in the relevant sector. However, closely linked to the research system are technology transfer/extension/education and training and other support services related to development. Therefore, the review team whilst emphasizing on the need for research, considered it necessary to look into development aspects too of the DNBG activities.

3. Sources of Information for the Review

- Presentation made by the Director General of DNBG
- Brief report of DG/DNBG submitted to SLCARP for the external review
- The National Botanic Garden Act of 2006
- Annual performance report of DNBG for the year 2018
- Consultations with flower growers, exporters and other stake holders facilitated by SLCARP
- Visits made to Royal Botanic Garden, Peradeniya and Dry Zone Botanic Garden, Mirijjawila and discussions with their staff and personal communications with relevant eminent scientists

CHAPTER TWO

2.1 Findings and Observations Made

The history of present Department of National Botanic Gardens (DNBG) goes back to ancient time where the origin of Royal Botanic garden (RBG) at Peradeniya had been the royal garden of ancient kings governed in central region of Sri Lanka. Since then, the British had taken initiatives to formally establish Royal Botanic Garden, Peradeniya, Hakgala Botanic Garden in Nuwara Eliya and Henarathgoda Botanic Garden in Gampaha in 1800 with clear objectives of ex situ conservation and scientific study of natural flora of Sri Lanka and providing opportunities for public to appreciate and enjoy the natural flora present in Sri Lanka. The available records and evidence clearly indicate that appreciable achievements had been made with respect to objectives of establishing botanic gardens. Accordingly, gardens situated at above locations had become attractive destination for both local and foreign tourist amounting to over two million visitors per year.

With the trends of reorganizing/ restructuring government institutions for various reasons, the botanical garden system which was under the Department of Agriculture had become an independent institution under the name "Department of National Botanic Gardens" (DNBG) in 2005 by a parliament act. Since then two new botanic gardens, one at Mirijjawila, in Hambantota district to represent dry zone region and one at Avissavwella in Rathnapura district to represent Wet zone region have been made.

This report covers the matters arising from study done by the review team based on the assigned TOR especially to report whether the functions of DNBG had been in accordance with the set objectives especially whether research aspect of DNBG is in operation efficiently and effectively for the development of improved technology as expected. The conclusions made by the review team are as follows;

- Impact made by the ex-situ and in-situ conservation and studies made on diversity of flora, maintenance of National Herbarium at RBG and National Red List of Sri Lanka completed in 2012 on natural environment and its long-term sustainability with effectively utilizing government funds is commendable
- Cadre revisions as well as filling vacancies of already approved cadre positions are immediate requirements
- No limitation on financial resources for research at present as only less than 0.1% of the total budget for DNBG is allocated for research. Botanic Garden Trust Fund (BTF) is a unique source of funding for DNBG

- Maintenance of residential gardens has been identified neither as an objective nor as a function of DNBG
- The research (R) and technology transfer (TT) are treated as one unit and there is no set rationale for distribution of resources among R and TT
- Coordination among finance, administration and technical divisions in managing scientific programs and financial resources is satisfactory (For 2018, financial progress was 97%)
- National and international recognition of the institution and its scientific staff is high due to proud history and possession of vast diversity of tropical flora maintained to the highest standard
- Product and product development oriented collaboration with other institutions in relation to Research is poor and most of the research projects have been conducted with university students and they are not focused towards a sound research agenda
- Competency and professionalism of present Directorate and the senior management is well accepted and definition of their roles and quality of the leadership are clear while their rapport with the staff has to be improved
- Government procedures, rules and regulations are adopted for determining staff requirement at all levels
- Scientific staff appears frustrated and scientific and technical staff are not well recognized and remunerated to the level they deserve
- No focused Research program on immediate and long term needs in Floriculture but Floristic Research is satisfactory and roles of various scientific disciplines in relation to Research Program are not very expanded
- Number of research publications appear adequate (about 100 for last five years) considering the limited human resources available, however, most of research studies have been conducted by university students and are ad hoc as they are not target oriented studies in a systematic research program
- The main role of scientific officers engaged in Research is not adequately focussed on Research but mostly directed towards providing other services and/or managing the system
- As R & TT are treated as one unit, R is given comparatively low priority as TT is a service that directly involves with stakeholders

- Although DNBG has released new Anthurium, Orchids and Chirita varieties and made fertilizer recommendations for flower growers to date, the recorded and potential outcome and impact of DNBG's Floriculture research is not visible to the level expected
- DNBG is cooperating well with public and private sector organizations, NGOs and flower growers and exporters in respect of providing services and technology transfer
- Although DNBG is collaborating with some universities, international research centres and private sector industries for research, this activity is very weak as DNBG has no sound and target oriented Research Program
- Mechanisms adopted to get the feedback of stakeholders on research at present is not adequate
- Transferring technological recommendations/research outcomes to relevant stakeholders and the information exchange and extension programs and the participation of the research staff therein appear efficient and effective
- No visible presence of formal Research Advisory Board or Research Sub-committee at DNBG and composition of the board of management does not provide adequate strength for advancement of research component
- Services provided by DNBG such as Consultancy and advisory services/training and extension services are satisfactory but laboratory services and services related to Floriculture are not provided to the level expected

2.2 Recommendations for Effective Planning and Implementing on Future Programs of DNBG

2.2.1 Need for Revision of Vision and Mission Statements

Vision: To become scientifically and aesthetically finest Botanic Gardens in the Tropics, while conserving plants and contributing to the economic growth of Sri Lanka.

Suggested vision: To become scientifically and aesthetically finest Botanic Gardens in the Tropics, while conserving, authenticating and possible utilization of flora contributing to the economic growth of Sri Lanka.

Mission: To provide opportunities for the public to study, sustainably conserve and admire plant resources in natural and manmade environments.

Suggested mission: Exploration, sustainable conservation, identification and utilization of plant resources and development of the floriculture industry while facilitating ecotourism to provide opportunities for the public to admire plant resources in natural and manmade environments.

2.2.2 Line Ministry

DNBG has been placed under various ministries from time to time in the past and this has hampered in achieving long term sustainable development programs,

- Recruitment of necessary qualified staff
- Providing trainings particularly overseas training for the scientific staff.

Presently DNBG is under the proper ministry of Forestry and Environment, which should not be changed in the future.

2.2.3 Maintenance of Residential Gardens

Maintenance of residential gardens is not indicated in objectives and functions of DNBG so that it may not be handled by DNBG and resources can be used in essential functions instead.

2.2.4 Recognition of Scientific staff

Measures that can be adopted at Direct General (DG) level to recognise scientific and technical staff have to be identified and adopted.

National and international training opportunities for the scientific staff should be explored and adequate funding for training should be provided by budgetary allocations.

2.2.5 Staff Recruitment and Promotions

Immediate recruitment of necessary scientific staff and giving due promotions at all levels are proposed.

Officers with post graduate qualifications and highly skilled labourers with long years of experience and proven record of achievements should be promoted to the highest level possible with an increase in remuneration.

A formal procedure must be formulated to provide incentives for productive employees.

2.2.6 Enhancing Research

Floriculture Research has to be enhanced including Research on export oriented flower plants like Sandriyana.

Research on activities related to Floristic though satisfactory at present, should be further enhanced to cater the sector needs.

A model Floriculture Research Units at Henarathgoda, Hakgala and Mirijawila Botanic Gardens are proposed and they should be placed under Assistant Directors.

2.2.7 Feedback

Getting a constructive feedback through local and global market signals and relevant stakeholders for Floristic and Floriculture research aspects is proposed.

For the above purpose, DNBG should conduct meetings annually with the participation of relevant DNBG staff, external experts and stakeholders.

Provide opportunities for visitors to the DNBG to propose their suggestions, needs and problems with minimum expenses and effort.

2.2.8 Restructuring of present Research (R) & Technology Transfer (TT) Division

A structural change to have a separate division for research under a Director position (already approved) including important disciplines such as Plant Taxonomy, Plant Conservation and Reproductive Biology, Crop Improvement, Agronomy, Crop Protection, Post-harvest Technology etc. with necessary facilities and qualified human resources is strongly recommended.

Under the Director (Research) two Deputy Director positions; Deputy Director (Research) Floristic and Deputy Director (Research) Floriculture are proposed.

Accordingly another division for Technology Transfer (TT) is required under the Director (TT), to undertake education and training and technology transfer activities.

2.2.9 Distribution of resources between R & TT

There should be a rationale for distribution of resources among R and TT.

Total funding for both R and TT (excluding salaries) should be distributed in the ratio of 60% for R and 40% for TT.

Human resources should be distributed among R and TT the other way round.

Botanical Garden Trust Fund (BTF) should be utilized maximally and spent mainly on research.

2.2.10 Research Agenda

DNGB has no visible sound and focussed national research agenda at present so that well formulated and systematic national research program focusing on short and long term research objectives covering both Floristic and Floriculture aspects is urgently needed.

2.2.11 Formulation of Sound Research Agenda

2.2.11.1 Annual Events: An effective annual procedure is proposed to formulate a sound National Research Program.

Propose to have an annual event for consultation for expert opinion of competent scientists.

Research proposals should be entertained from suitably experienced and qualified plant scientists on nationally identified subject areas of interest to DNBG mandate through News Paper Advertisements and digital media.

2.2.11.2 Appointment of an Advisory Board: Appointment of an Advisory Board for effective planning and implementing the National Research Program of DNBG is an immediate requirement.

An Advisory Board may be appointed with the following composition chaired by DG/ DNBG for a period of 3 years funded by BTF and should be renewed once in three years;

2.2.11.3 Subject Specialties of the Members of the Advisory Board: Systematic Botany/ Taxonomy, Plant systematics, Conservation, Reproductive biology, Landscape gardening, Plant Molecular Biology, Plant Breeding and Genetics, Plant Pathology, Entomology, Plant Physiology, Agronomy, Biochemistry/ Natural Products specialist, Horticulture.

2.2.11.4 Qualifications of the Advisor Board Members: PhD in relevant disciplines with 10 years of experience after post graduate qualification and proven track record of scientific publications and research accomplishments

2.2.12 Cooperation with Other Institutes

The functions of DNBG are difficult to be undertaken in isolation without collaboration with other relevant institutions.

Cooperation and collaboration with other research institutes and with national development programs, private sector organizations and other stake holders should be strengthened.

Some relevant institutions with which DNBG must formulate procedures for collaboration; Forest Department, Dept. of Wildlife, Dept. of Agriculture, Ayurvedic Research Institute, Coastal Conservation Authority, National Universities: Faculty of Botany/ Plant Science, Faculty of Agriculture, Faculty of Graduate Studies and Tourist Board – Tourist hotels to promote regional/ ecological theme parks.