

PERFORMANCE REVIEW
of the
NATIONAL AQUACULTURE DEVELOPMENT
AUTHORITY OF SRI LANKA
(NAQDA)
(2017 - 2019)

A report prepared for the
NATIONAL SCIENCE AND TECHNOLOGY
COMMISSION
(NASTEC)

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Abbreviations

MFARD	Ministry of Fisheries and Aquatic Resources Development
NASTAC	National Science and Technology Commission
UNDP	United Nations Development Programme
NARA	National Aquatic Resources Research and Development Agency
BOM	Board of Management
SAR	Self-Assessment Report
SDG	Sustainable Development Goals

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All the Heads of Divisions with their senior officers of NAQDA graciously agreed to meet the review panel and exchanged views and provided us insights which were valuable in arriving at our recommendations. All the officers and employees of NAQDA and individuals represented different stake holders whom we consulted fully cooperated with the review team. Review team appreciate their cooperation. The co-ordination of all review activities, initially by Finance Director and later by Mr K.M.D.M. Somarathna Assistant Director (Planning Monitoring) is gratefully acknowledged.

Executive Summary

The **Science & Development Act No. 11 of 1994** mandates the National Science and Technology Commission (NASTEC) to review the progress of S&T institutions in relation to objects set out in Section 2 of the Act. National Aquaculture Development Authority of Sri Lanka (NAQDA) is established and governed by the National Aquaculture Development Authority Act No. 53 of 1998 and National Aquaculture Development Authority of Sri Lanka (Amendment) Act, No. 23 of 2006. NAQDA's functions include development and management of all freshwater aquatic resources i.e., inland fisheries, which are generally capture and culture-based, and the aquaculture industry including sea farming.

An independent review panel consisting of three members was appointed by NASTEC in consultation with the NAQDA to review the institution from 2016 to 2019. The review was conducted as per the Terms of Reference (TOR) given for the Performance Review.

The mandate of NAQDA is in strict conformity to Government Policy and has been designed to address issues pertaining to food security, employment generation, earning of foreign exchange through development of inland fisheries and sustainable aquaculture while conserving the environment.

NAQDA had a total of 723 employees. This include Chief Executive Officer, Senior Managers (04), Middle Managers (26) Junior Managers (79), Management Assistants -Technical (121), Management Assistants – Non Technical (81) and Primary Level employees (411).

The projects / programs conducted by NAQDA can be categorized in to several major development areas of aquaculture and Inland fisheries and fall under the categories of culture-based fisheries, ornamental fish farming, crab farming, milkfish culture, seabass culture, freshwater prawn farming, shrimp farming, mollusk culture and sea cucumber farming and seaweed farming.

The total inland fish and aquaculture production has increased to 90,580 Mt in 2019. The inland fish production from culture-based capture fisheries in the perennial reservoirs and inland aquaculture production has increased by 5% compared to 2018. The inland fish and aquaculture production is valued at around Rs. 27. billion and has contributed significantly to the national economy. It is estimated that the foreign exchange earned through Shrimp exports was Rs. 3,522 Mn and Ornamental fish exports was Rs. 2,913 Mn. NAQDA has produced 144 mn fry

and 89 mn fingerlings. NAQDA also contributes towards sustainable development goals of end poverty, end hunger, responsible consumption and production and life below water.

NAQDA's involvement in proper management of the water bodies with community participation, stock enhancement in reservoirs, increased fry and fingerling production has contributed to the increase in inland fish production while technical guidance, careful monitoring, and implementation of regulations have led to diversification and increase in aquaculture production.

Enhancement of capacities/ facilities/ infrastructure / operational systems in aquaculture development centers; enhancement of skills, abilities, and competencies of staff to enhance their performances and to address technological problems they face; proper research backing for the verification of existing technologies, development of new technologies and other development activities; addressing issues in quality, quantity, cost, ingredients availability for feed formulation and commercialization; improvements in extension, farmer training, development of efficient communication networks; information sharing among farmer community and effective mechanisms in technology transfer are the main issues to be addressed to further improvement of the performance of NAQDA. However, although NAQDA is a regulatory body, it does not have sufficient legislative power with respect to reservoir fisheries management and regulation of new areas of aquaculture.

Concerns over environmental impacts, effluent management, self-pollution, biodiversity issues, climate change vulnerability, combating climate change impacts and adaptations, are current issues to be addressed by NAQDA. Low cost aquaculture, non-fed aquaculture and extensive aquaculture and further diversification of aquaculture systems are suggested to address sustainability issues. Private sector and community involvement for reducing production cost, species diversification, and freshwater fish seed production should be strengthened.

1.0 Introduction

Overview of National Aquaculture Development Authority (NAQDA)

History

NAQDA is established and governed by the National Aquaculture Development Authority Act No. 53 of 1998. NAQDA's functions include development and management of all freshwater aquatic resources i.e., inland fisheries, which are generally capture and culture-based, and the aquaculture industry including sea farming. There has been an amendment to the principal act, the National Aquaculture Development Authority of Sri Lanka (Amendment) Act, No 23 of 2006.

Vision

The vision of NAQDA is to be an apex body in the region responsible for sustainable development and management of aquaculture and inland fisheries to ensure food security in order to improve the quality of life of the people.

Mission

The mission of NAQDA is to contribute to the improvement of the socio-economic conditions of rural societies through alleviation of poverty by increasing freshwater and brackish water fish production and introducing new technologies for utilization of aquatic resources for small-, and large-scale enterprise development.

Mandate

The functions or mandate of the NAQDA are to:

- Develop aquaculture, aquaculture operations and culture-based fisheries in perennial reservoirs and seasonal reservoirs, with a view to increasing fish production and fish consumption in the country;
- Promote the creation of employment opportunities through the development of freshwater aquaculture, brackish water aquaculture, coastal aquaculture and mariculture;
- Promote the farming of high valued fish species, including ornamental fish, for export;

- Promote the optimum utilization of aquatic resources through environmentally friendly aquaculture programmes;
- Promote, facilitate and develop small, medium and large-scale private sector investment in aquaculture;
- Manage, conserve and develop, having regard to the need to conserve biodiversity, aquaculture, aquatic resources used for aquaculture and the aquaculture operations and culture-based fisheries in perennial reservoirs and seasonal reservoirs;
- Assist persons carrying on business, as an importer, exporter, seller, distributor and supplier of aquatic resources and engaged in aquaculture and the development of aquatic resources as an importer, exporter, supplier and distributor and seller of aquatic resources;
- Prepare and implement plans and programmes for the management, conservation and development of aquaculture and aquaculture operations and culture based fisheries in perennial reservoirs and seasonal reservoirs; and
- Conserve and rehabilitate aquatic resources devastated by poor aquaculture practices.

The mandate of NAQDA is in strict conformity to Government Policy and has been designed to address issues pertaining to food security, employment generation, earning of foreign exchange through development of inland fisheries and sustainable aquaculture while conserving the environment. NAQDA is the apex body responsible for the development and promotion of this mandate together with other government organizations and the private sector stakeholders.

The Corporate Plan

NAQDA does not have a Corporate Plan for the period under review but NAQDA has prepared Aquaculture and Culture Based Fisheries Sector Development Plan for 2021 to 2025.

Governing Ministry

NAQDA functions under the purview of the Ministry of Fisheries & Aquatic Resources Development.

Sources of Funding

NAQDA, being a government statutory organization receives the annual capital and recurrent budgets from the Government Treasury. Funds are also generated internally mainly from the sale of fish seeds. Other sources include rent income, income generated by training institutions, fines, license income etc. In addition, there were Foreign funded projects during the period under review.

Organizational Structure

- NAQDA is governed by the Chairman and the Board of Management (BOM). The BOM decides on the policies and the Director General is the chief executive officer responsible for implementing and coordinating the activities. NAQDA has total approved cadre for employees and has total of Employees as at 31st August 2020. The organizational structure of NAQDA is given in Figure 1. As indicated in the Table 2, the organization has several aquaculture Development Centers, Breeding Centers Training Centers, Monitoring and Extension units and 22 District Aquaculture Extension Offices.

Figure 1. Organization structure of NAQDA.

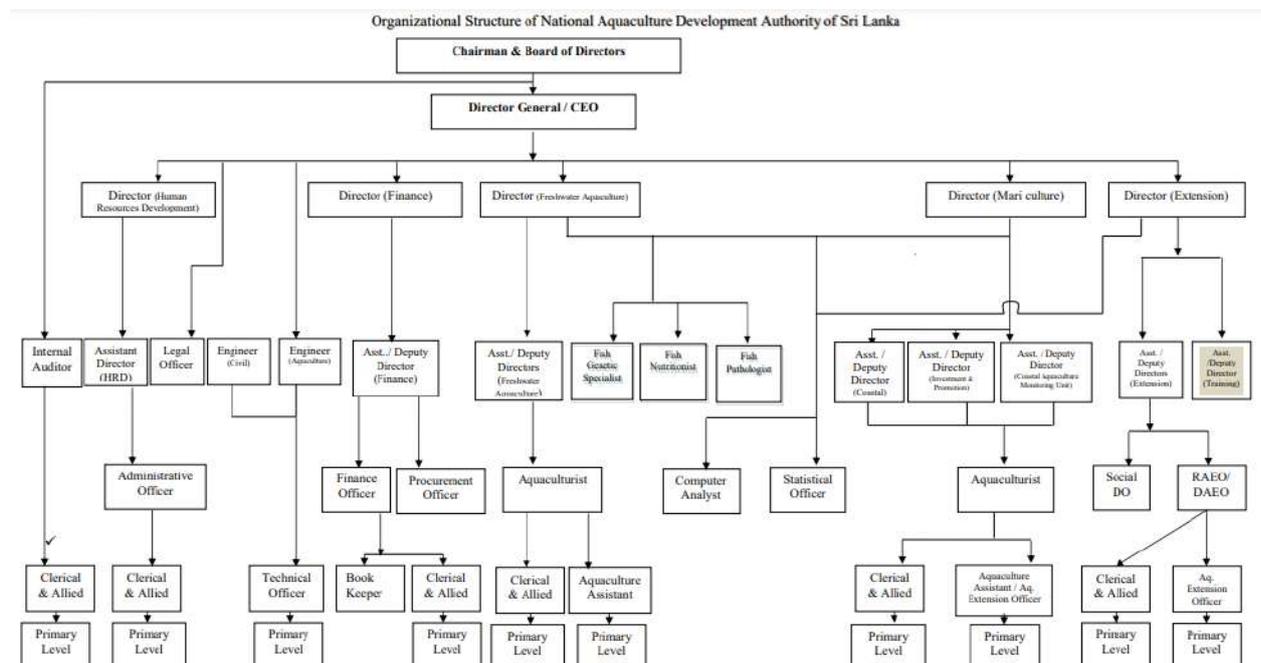


Table 2. Aquaculture Development Centers, Breeding Centers Training Centers, Monitoring and Extension units.

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- Aquaculture Development Centre, Udawalawa (Carp)
 - Aquaculture Development Centre, Dambulla
 - Aquaculture Development Centre, Inginiyagala
 - Aquaculture Development Centre, Nuwara Eliya
 - Aquaculture Development Centre, Udawalawa (Tilapia)
 - Aquaculture Development Centre, Iranamdu
 - Aquaculture Development Centre, Muruthawela
 - Aquaculture Development Centre, Udawalawa
 - New Aquaculture Development Centre, Sevanapitiya
 - Freshwater Prawn Breeding Centre, Pambala
 - Freshwater Prawn Breeding Centre, Thillawatawena
 - Freshwater Prawn Breeding Centre, Kallarawa
 - Ornamental Fish Breeding and Training Centre, Rambodagalle
 - Ornamental Fish Breeding Centre, Ginigathhena
 - Multi Species Marine Fin fish hatchery, Dharmapuram
 - Inland Fisheries and Aquaculture Training Institute, Kalawewa
 - Coastal Aquaculture Monitoring and Extension unit, Battuluoya with Laboratory complex
 - Coastal Aquaculture Monitoring and Extension unit, Batticaloa with Laboratory facilities
 - Coastal Aquaculture Monitoring and Extension unit, Northern Province
 - 22 District Aquaculture Extension Offices Island wide
-

2.0 Procedure adopted for the review

An independent panel comprising of three members appointed by NASTEC carried out the review. The Panel members were:

Prof. J.M.P.K. Jayasinghe, Emeritus Professor of Aquaculture and Fisheries, Wayamba University of Sri Lanka.

Prof. U.S. Amarasinghe, Emeritus Professor in Zoology, University of Kelaniya.

Prof. K.H.M.A. Deepananda, Professor of Fisheries Biology, University of Ruhuna.

The Review Panel was formally informed about the review procedure at a meeting held on 15th September 2020 at NASTEC Head Office, Sethsiripaya by Dr. MS Nazeema Ahamad Acting Director, NASTEC.

On 24th September 2020, a meeting of NASTEC officers and key officials of NAQDA was held to introduce the panel and to brief about the review to NAQDA key officials of NAQDA. The review was based on the Terms of Reference (TOR) given for the Institutional Review of the Science and Technology Institutions developed by NASTEC. Performance assessment is mainly based on the SAR produced by NAQDA. However, the team requested for additional information and evidence in order to strengthen the review.

The Review Panel had an introductory meeting with Chairman and Director General and Heads of the Divisions, DG made a presentation on overview of the Institution and it was followed by a discussion with senior staff.

Brief separate preliminary meetings were conducted with the Heads of Freshwater Aquaculture Division, Coastal Aquaculture Division, Aquaculture Engineering unit, Extension division, Administrative staff, Legal officer and Audit staff separately. Subsequent visits to NAQDA were focused on the Aquaculture Development Centers, Breeding Centers Training Centers, Monitoring and Extension units. Different categories of staff in those centers were contacted either by zoom meetings or through telephone conversations when zoom facilities were not

available or weak. Different trade unions of different staff categories were contacted separately to obtain their views and suggestions. The key position holders of the trade unions of Aquaculturists and Extension officers gave very constructive suggestions regarding upliftment of the services rendered by NAQDA and also the common problems they encounter. Relevant Research staff of NARA which is the research wing of the Ministry of Fisheries and Aquatic resources were met and some were consulted through WhatsApp. Selected members of the Inland Aquatic Resources and Aquaculture Division and Post-harvest Division of NARA were consulted to identify their contribution and cooperation in identification of researchable issues and prioritization of research activities with NAQDA. Please note that the restrictions imposed by the Government due to COVID 19 outbreak delayed mainly the stakeholder consultation process and the performance review.

3.0 Management Assessment

The objective of the management assessment is to identify causes that enhance or hamper the performance of that institution to produce useful and relevant outputs depend on internal policies, strategies, management practices etc. of NAQDA.

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

Management practice	Level of Practice (Performance Indicators)			Comments / Evidence
	Strong	Moderate	Weak	
Government policies and development goals are used/ considered to establish goals and plan organizational strategy for the institution	√			
The organizational mandate (as specified by the relevant Act) is considered in strategic planning	√			
The institution is responsive to changes in Government policies and strategies	√			
Factors such as strengths, weaknesses, threats and opportunities are considered in strategic planning		√		Strategic plan available only for 2021-2025
Stakeholders needs are taken into consideration in strategic planning	√			

The Board of Governors is involved in strategic planning	√			
The extent to which staff members are involved in strategic planning		√		Weekly meetings are held with Directors and ADs, to discuss progress of activities. Staff involvement is needed to be strengthened because at present, their involvement towards working to common goals is not very much focused.
Government allocations and alternative funding opportunities (donor funding) are considered in strategic planning	√			Strategic plan available only for 2021-2025
The extent to which policies and plans of the organization are reviewed and updated	√			

Additional observations (if any)

Realizing the weak role of zonal assistant directors of NAQDA, recently NAQDA authorities decided to promote zonal directors to a position of task managers.

ii) Planning S & T programs and setting priorities

Management practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
National development goals are considered in planning programs & setting priorities	√			
Board of Governors participate in planning and priority setting of program	√			There is no strong influence, but there is a significant contribution for the issues related to national economy.
The extent to which the staff of the institution participate in programme planning and priority setting		√		

Stakeholder interests are considered in programme planning	√			
The extent to which programmes are planned and approved through appropriate procedures		√		There is no perfect procedure. Some mechanisms exist, but further strengthening is necessary.
The extent to which the availability of funds (government allocations and other funds) generating funds are taken into consideration in planning programmes	√			Earned income can be used for day-to-day activities. Disadvantage is that fixed amount of treasury funds is not sufficient.
The obtaining of necessary equipment is considered in planning programmes	√			
Stakeholders are represented in the institution's planning and review committees.		√		

The extent to which socio economic and commercialization of aspects are considered in programme planning.	√			
Effectiveness and efficiency of institutional procedures in approving new S& T programmes.	√			

iii) Planning S& T/ R& D Projects

Management practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
The staff is provided with guidance for project planning	√			
Previous research results/data are used for planning projects	√			
The extent to which the institution follows a formal process for preparation, review and approval of projects	√			
The extent to which organizational plans (e.g. medium-term plan, corporate plan, strategy etc.) are used to guide project selection and planning	√			
Multidisciplinary projects/ activities are encouraged by the institutions	√			

Foreign collaborations are encouraged and incorporated in planning.		√		Foreign collaboration is mainly initiated by MOFAR.
Partnership with private sector is encouraged by the institution		√		
The extent to which development research/activities are considered in planning projects	√			
The extent to which basic research are considered when planning projects		√		Poor adoption of available research findings, except in special situations where staff members have been trained locally at postgraduate levels.

<p>The degree to which adverse effects on environment are considered in planning projects</p>	<p>√</p>			<p>In Aquaculture Development Centres, sedimentation tanks have been constructed. Measures have been taken to minimize adverse impacts on the environment.</p>
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Additional observations (if any).

Establishment of an environmental sub-unit (under monitoring and evaluation division) to monitor and mitigate environmental issues related to aquaculture development can improve the environmental sustainability of the projects/ activities of NAQDA.

iv) Project management and maintenance of quality

Management Practice	Level of Practice (Performance Indicators)			Comments / Evidence
	Strong	Moderate	Weak	
The effectiveness of the procedures for resource allocation at different levels (organization, departments, program etc.)	√			
Ensuring that instruments, equipment and infrastructure facilities are sufficient for implementation of projects		√		Limitation due to budgetary allocation for infrastructure development.
The effectiveness of administrative procedures and support for project implementation (procurement and distribution of equipment and materials, transport arrangements, etc.)	√			
Formal monitoring and review processes are used to direct projects towards achievement of objectives		√		
The extent to which the researchers are supported by the required technical / field staff.	√			

Ensuring that established field / lab methods, and appropriate protocols are used	√			
Rresearch projects/ S& T activities are completed within the planned time frame.	√			The only constraint is timely rainfall (climatic factors), which affects targets to be achieved.
Ensuring that scientists / researchers have access to adequate scientific information (scientific journals, internet, international databases, advanced research institutes, universities etc.) that strengthens the quality of research.		√		There are issues related to interpretation of research results in the literature into practice.
The extent to which quality assurance practices are followed by the institutions	√			
Ensuring that researchers/ scientists have access to computers and necessary software	√			

Additional observations (if any)

Monitoring and review processes are now formalized through a new unit of monitoring of activities. Data are shared with the Provincial Councils once in 3 months. There is a data recording procedure in AQDCs. Raw data are made available for any person on request. The purpose of acquiring data should be clearly indicated in the letter of request.

Accreditation of selected laboratories and test services offered has to be considered.

v) Human Resource Management

Management Practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
The institution maintains and updates staff information in a database (including bio data, disciplines, experience, publications, projects)	√			There is no mechanism to maintain information based on performance.
The institution, plans and updates its staff recruitments based on programme and project needs		√		See the note below.
The effectiveness of the selection procedures and the schemes of recruitment	√			See the note below.
Training is based on institution and program objectives and on merit	√			

The effectiveness of the procedures in promoting a good working environment and maintaining high staff morale.		√		In 2018-2019, there was a reward scheme to appreciate services of officers.
The effectiveness of staff performance appraisals		√		
The effectiveness of rewards and incentive schemes in motivating the staff			√	
The effectiveness of managing staff turnover, absenteeism and work interruptions.			√	

Additional observations (if any)

There is a problem of over-staffing in the south and under-staffing in the other parts of the country. This discrepancy was due to political influences. Presently, this discrepancy cannot be rectified due to humanitarian grounds. To rectify this, NAQDA has made arrangements to recruit new persons from the areas concerned, and that they should work in that area at least for 5 years.

Lack of sufficient incentives to retain staff of S & T category interrupts the smooth operation of the work programme.

vi) Management of organizational assets

Management Practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
The ability of the institution to carry out its mandate and the assigned statutory powers	√			
Infrastructure (buildings, stations, fields, roads) is satisfactorily maintained.	√			
Vehicles and equipment (lab, field, office) are properly managed and maintained.	√			
The effectiveness of procedures to ensure that equipment are in working order	√			

The effectiveness of the institution's overall strategy in generation and proper utilization of funds	√			Selling of fish fry and fingerlings and post larvae of freshwater prawn is a significant source of income. There are some malpractices as this is involved money at regional level which at present is difficult to monitor.
The extent to which the institution identifies opportunities for income generation and cost recovery	√			
The extent to which the intellectual property rights of the institute are protected	√			

Additional observations (if any)

Mechanisms are established to monitor regional level financial handling under the finance division. The mechanism is now proven to be effective. There was a suggestion that financial assistant should be appointed to all regional centers because the OICs are biologists to deal with live animals but not having any knowledge about finances.

vii) Coordinating and integrating the internal functions/ units/activities

Management Practice	Level of Practice (Performance indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
The extent to which institution is evaluated internally and restructured based on current needs	√			
The effectiveness of internal communication and coordination mechanisms	√			
Institution's overall direction and coordination are provided by a central planning committee / unit.		√		Group e-mails and formal letters are used for communication and coordination by the Head Office.
The extent to which different units are assigned clearly defined functions	√			
Responsibilities of research / management staff are clearly identified	√			
Effectiveness of using appropriate reporting procedures and feedback in management at different levels	√			

Additional observations (if any)	
(i)	Recently, a new position ‘Task Manager’ was created and the task managers were appointed. For internal evaluation of the performance of the activities, a new unit has been established.
(ii)	Recently, for effective internal communication, video conferences, e-mail communication and WhatsApp groups have been introduced. The evaluation team, however, noted that these online communication systems were not effective; only two regional level officers could be contacted for online meeting.

viii) **Partnership in managing information dissemination**

Management Practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
The institution systematically plans and performs dissemination of information	√			Annual action plans are prepared indicating fund allocation, targets in the four quarters, physical progress, expected benefits and officers responsible.

The extent to which the institution plans and maintains linkages with key partners for sharing and dissemination of information	√			Annual reports are prepared and published in the NAQDA website.
The effectiveness of institutional procedures for technology transfer	√			Regular training programmes are conducted with the help of experts.
The effectiveness of the system to obtain feedback from different types of stakeholders	√			Upon request of stakeholders, meetings are conducted.

Additional observations (if any)

Once in 2 months, meetings are conducted with the fisheries officials of Provincial Councils. NAQDA Act is being amended and in the proposed ‘Aquaculture and Culture-Based Fisheries Act’ (ACBFA), there are several provisions available for multi-sectoral coordination. The draft Act has been approved by the Legal Draftsman’s Department and will be submitted for Cabinet Approval.

ix) Monitoring, evaluation and reporting procedures

Management Practice	Level of Practice (Performance Indicators)			Comments/ Evidence
	Strong	Moderate	Weak	
The institution monitors and evaluates (M&E) its own activities periodically	√			Monthly progress reports are submitted. Progress review meetings are held once in 2 months.
M&E is supported by an adequate management information system (MIS), which includes information on projects (e.g. costs, staff, progress, and Results).		√		Financial progress and technical progress are not integrated.
The extent to which S& T results and other outputs are adequately reported internally (e.g. through reports, internal program reviews, seminars).	√			Project completion reports are submitted. Institutional action plan is monitored monthly.

External stakeholders contribute to the M & E process in the institution		√		There should be a mechanism to consult stakeholders in the M & E process, which is presently weak and <i>ad hoc</i> .
The extent to which the results of M&E are used for project/ research planning and decision-making.		√		Training programmes are conducted to share results of monitoring and evaluation. At the monthly progress review meetings findings of M & E process are presented to higher administrative levels in the MOFAR.

Additional observations (if any)

In 2020, integration of financial progress and technical progress was introduced in the institutional monitoring and evaluation process.

4.0 Output Assessment

In assessing the output of NAQDA, those relevant indicators were selected out of those listed in the NASTEC review manual (Technologies developed, Technologies transferred to industry/ entrepreneurs, Information Dissemination/ Extension, Research Publications, Patents, Services (Testing, Calibrations, Consultations, Advisory services, Trainings).

Considering the role of NAQDA as a service organization, its outputs can be grouped into two categories; direct outputs and indirect outputs. Direct outputs include production of seed for aquaculture, stocking of reservoirs with fingerlings and post-larvae of freshwater prawn to promote culture-based fisheries. Indirect outputs are, regulatory roles performed (e.g., regulatory measures for shrimp production, involvements in strengthening and organizing fisher societies, social mobilization and monitoring of activities of community-based organizations, etc.

4.1. Projects conducted, technologies developed and related outputs

NAQDA comes under the Ministry of Fisheries and Aquatic Resources Development of Sri Lanka and is the mandatory organization to develop the aquaculture industry in the country.

The projects/ programs conducted can be categorized in to several major development areas of Inland fisheries and aquaculture which fall under the categories of Culture based Fisheries, Ornamental fish farming, Crab farming, Milk fish culture, Sea bass culture, Freshwater prawn farming, Shrimp farming and sea cucumber farming and seaweed farming, etc. In addition, Climate Resilient Tilapia pond Culture project (TCP / RAS / 3603) has been conducted and concluded with the objective of Sustainable Increase of Tilapia Aquaculture Production in Sri Lanka.

NAQDA has undertaken several infrastructure/ capacity development programmes to enhance aquaculture seed production, to develop capacities in monitoring shrimp farming activities and providing disease diagnostic facilities, aquaculture related analytical facilities, increasing aquaculture production capacities and those are summarized in table 3.

Table 3. Infrastructure/ capacity development programmes undertaken during the period of review.

Projects/ activities conducted	Output/ progress general comments etc.
Establishment of a Wet lab and associated structures – Rambodagalle at Ornamental fish Breeding & Training Centre	Work completed, Capacity for the production breeding ornamental fish species and has increased
Establishment of Shrimp Farm Monitoring Unit, Batticaloa – Stage III	Monitoring unit established. The unit is engaged in monitoring, guiding, record keeping, advising and implementing rules and regulations in Batticaloa District.
Establishment of PCR Laboratory at Shrimp Farm Monitoring Unit, Batticaloa	Capacity enhancement of the disease identification and control of shrimp diseases are the outcomes.
Establishment of crab city	Ongoing project with the objective of promoting crab culture activities/ technology in Sri Lanka.
Improvement of Pambala Hatchery	Project completed. The seed production capacity has been increased while improving the quality of the larvae produced.
Establishment of Ornamental Fish breeding Centre, Sevanapitiya – Stage I	Ongoing
Establishment of Aquaculture Industrial Parks (Establishment of mega fishery zones in selected areas in the coastal belt)	Ongoing. Land Acquisition/ land allocation problems are delaying the progress
Establishment of Rekawa Crab City, Hambanthota	Yet to be completed.
Establishment of Milk Fish Hatchery, Bangadeniya in Puttalam District	In progress
Establishment of Sea cucumber hatchery Oleithuduwai in Mannar District	Construction of the facility completed. Awaiting for Production process
Climate Resilient Tilapia pond Culture in Sri Lanka (TCP / RAS / 3603)	Completed

Ornamental Fish Breeding Centre (Carp & Gold fish), Sevanapitiya	
Marine Ornamental Fish Breeding Centre	

4.1.1. Technologies verified and improved.

NAQDA has verified and improved breeding/ rearing technologies for the following aquaculture species:

Breeding technology for the selected sea cucumber species.

Pen and pond rearing technology for selected species of sea cucumber.

Breeding technology for milkfish/ sea bass.

Breeding technology for mud crab.

Culture technology for seaweeds.

Live rock farming

Coral culture

Technology, SPF for *Penaeus monodon* / *Litopenaeus vannamei* breeding and culture

Tissue culture of aquatic plants

Cryo-preservations of sperm of carps

Breeding in captivity of indigenous freshwater species. E.g., *Wallago attu*, *Labeo dussumieri*, *Channa striata*, *Ompok bimaculatus*, *Etroplus suratensis*.

New strain development of ornamental fish: guppies, swordtails and angles

Introduce cohort breeding for genetically improved farmed tilapia (GIFT) variety of Nile tilapia

Fish Farmers were made aware of appropriate mitigation and adaptation methods applied for climate resilient farming systems through implementation of better aquaculture management practice. Also, some species such as saline tilapia was introduced as a climate resilient aquaculture species.

4.1.2. Research and Development programmes.

Small Research Activity (SRA) on the Development of a culture-based fishery for giant freshwater prawn in Sri Lankan Reservoirs has been concluded as a collaborative research project. Australian Center for International Agricultural Research (ACIAR) Project, and the Collaborators are from James Cook University, Australia, Wayamba University of Sri Lanka and University of Ruhuna.

The Project was to conduct research on current stock and recapture strategy for giant freshwater prawn in selected reservoirs of Sri Lanka with a view to improving the overall yields and fisher family/community incomes that will contribute towards the long-term sustainability of the practice. The project will also identify knowledge and capacity gaps for a larger and longer-term research project.

Based on the findings of this SRA, a long-term project has been designed with the same collaborative institutions, which is scheduled to commence on 1st July 2021.

4.1.3. Training programmes.

Training programmes conducted by NAQDA during the review period includes one National Training program, 108 Ornamental fish Breeding /Feeding/ Aquatic plants culture programmes.⁷⁷ aquaculture related programmes at NIFATI, Kalawewa and Ornamental fish breeding and training center, Rambodagalle.

4.1.4. Conferences/ workshops and other awareness programmes.

Main Conferences/ workshops and other awareness programmes conducted include: National inception Workshop, Project evaluation Workshop, Workshop on AHPND National Consultation, Workshop on Preliminary recommended actions to better attract local and foreign investors to develop a commercial marine aquaculture sector, Workshop on Expansion of sea weed Culture, Investors forum for Aquaculture. NAQDA has also organized a symposium on “Sustainable Inland Fisheries and Aquaculture for Food Security and Nutrition” and has co-sponsored a meeting on Aquaculture of Commercially Important Finfishes in South Asia with the SAARC Agriculture Centre.

4.1.5. Test Services

Test services and disease diagnosis services are offered by NAQDA. Charges are nominal. Some services are offered free, while from some services only 50% of the cost is recovered.

Services available at the brackish water environmental and fish health laboratory Battuluoya are for the identification of; WSV Infectious Hypodermal & Hematopoietic Necrosis Virus (IHHNV), Infectious Myonecrosis Virus (IMNV), Taurasyndrome Virus (TSV), Yellow Head Virus (YHV), Necrotizing Hepatobacterium (NHPB) and Acute Hepatopancreatic Necrosis Disease/Early Mortality Syndrome Virus (AHPND/EMS).

At Rambodagalla ornamental fish breeding and training center, disease diagnosis and treatment of ornamental fish species are carried out. In this center, more than 2000 samples are analyzed annually. Test services are also available for identification of pathogenic Bacteria, Parasites and Lethal algae at Ranbodagalla center.

4.1.6. Awards and publications

Type of publications of NAQDA include, research papers in refereed journals, presentations in research symposia, regional workshops, extension leaflets, information leaflets, training manuals, leaflets with technical information and newsletters. Some are in the form of abstracts.

During the year, 2019 NAQDA has conducted a Symposium under the theme “Sustainable Inland Fisheries and Aquaculture for Food Security and Nutrition”.

In 2019, NAQDA has jointly organized the regional meeting on Aquaculture of Commercially Important Finfishes in South Asia with the SAARC Agriculture Centre (SAC), Dhaka, Bangladesh. The proceedings of this meeting is published in “S.S.Giri, S.M.Bokhtiar, S.K.Sahoo, B.N.Paul and S. Mohanty, Eds. (2019). Aquaculture of Commercially Important Finfishes in South Asia. SAARC Agriculture Centre, SAARC, Dhaka, Bangladesh, vi + 196 p.” Officers of NAQDA has contributed writing three chapters for this publication.

Symposium on Sustainable Inland Fisheries and Aquaculture for Food Security and Nutrition was held on 30-31 May 2019 at the National Inland Fisheries and Aquaculture Training Institute (NIFATI) in Kalawewa, Vijithpura. There were 22 oral presentations and 8 poster presentations where NAQDA officials were either first authors or co-authors. Researchers from NARA and Universities were also invited for the presentations.

In addition, staff of NAQDA has published articles in the Sri Lanka Journal of Aquatic Sciences, Journal of Applied Phycology, Third International Conference of Fisheries and

Aquaculture, Forth International Conference of Fisheries and Aquaculture, Faculty of Agriculture Undergraduate Research Symposium. Faculty of Agriculture, University of Peradeniya, Applied Sciences undergraduate Research sessions, Faculty of Applied Sciences, Rajarata University of Sri Lanka, 2nd International Research Symposium, Uva Wellassa University. 7th Annual Research Symposium proceedings, Faculty of Agriculture, Rajarata University of Sri Lanka, Recent Advances in Cryopreserved Sperm Motility and Hatching Success of Embryos of Indian Major carp *Catla catla*, Sri Lanka, Journal of survey in fisheries Sciences, 68th Annual convention of the Sri Lanka Veterinary Association. Ruhuna journal of science. International Journal of Current Research, twenty second scientific sessions of the Sri Lanka Association for Fisheries and Aquatic Resources, proceedings of National Aquatic Resources Research and Development agency(NARA) Scientific Sessions, Annual Research session, Faculty of animal science and export agriculture Uva Wellassa University, 5th Research Symposium of Uva Wellassa University. 5th Ruhuna International Science and Technology Conference (RISTCON) Sri Lanka, 7th Research Symposium of Faculty of Agriculture, Rajarata University of Sri Lanka during the period under review.

Organizing annual events such as symposia where NAQDA officials can share their findings and experience with a wider audience including researchers and industry personnel are recommended. Reviving of Inland fisheries journal, production of occasional papers to address specific issues, regular publication of Newsletter, regular updating of the website, initiation of a web forum in the NAQDA official web site to promote interaction with stakeholders are other suggestions.

5.0 Productivity of the Institution

NAQDA had a total of 723 employees according to latest available annual report. This include Chief Executive Officer, Senior Managers (04), Middle Managers (26) Junior Managers (79), Management Assistants -Technical (121), Management Assistants – Non Technical (81) and Primary Level employees (411).

Principal activities of the National Aquaculture Development Authority are the sustainable development and management of aquatic resources and Aquaculture industry of Sri Lanka with a view to increasing production and consumption of inland fish, creation of employment opportunities and increasing export volume of aquatic products. Aquaculture Development activities, production of seeds, offering Analytical services, offering Consultancy services, Quality assurance services, technology development, verification and transfer, Aquaculture Science popularization, Facilitating R & D activities, Information dissemination, and Research recommendations are some of the other activities that NAQDA officers contribute.

Most important specific activities include production of fry/ fingerling, production and distribution of seeds/ fingerlings of the aquaculture specie, regulation and stocking activities related to inland fisheries and monitoring/ licensing of aquaculture activities. During 2019 under monitoring activities, 523 Aquaculture Management licenses including 477 Shrimp Farms, 40 Shrimp Hatcheries and licenses for 6 brood stock collectors have been issued.

Science and Technology staff of NAQDA is adequately trained and 02 PhD holders, 02 MPhil holders and 21 trained at MSc or equivalent and 80. Basic degree holders serve the Institution as per SAR submitted. In addition, considerable number of staff are diploma holders. It is recommended to provide more opportunities and encourage S&T staff to get trained at Post Graduate level

Officers specialized in Pathology, Nutrition, Genetics are an additional strength to NAQDA. Most of the S&T staff has attend foreign training and had given opportunities to participate in specialized training programmes, other short-term training, workshops and seminars, study tours within and outside the country.

To cater to the needs of the seed, fry fingerlings for aquaculture activities NAQDA has well established network of Aquaculture development centres in Udawalawa, Dambulla, Inginiyagala, Nuwaraliya, Iranamadu, Muruthawela, Sevanapitiya, Fresh water prawn

breeding centers at Pambala and Kahadamodara and Kallarawa, Training and other needs of the ornamental fish farmers are looked after by Rambodagalla, and Ginigathena stations. Also, a multi-species marine fish hatchery has been established in Batticaloa to verify breeding technologies related to marine fin fish. Inland Fisheries and Aquaculture Training Institute, at Kalawewa is a fully-fledged training center with demonstration and residential facility for trainees. Coastal Aquaculture Monitoring and Extension unit, Battuluoya and Coastal Aquaculture Monitoring and Extension unit, Batticaloa have Laboratory facilities to offer analytical services and advisory services to shrimp industry. NAQDA maintain an efficient extension network through 22 District Aquaculture Extension Offices Island wide.

5.1. Fry production:

The Aquaculture Development Centers (AQDCs) at Udawalawa, Dambulla, Inginiyagala, Iranamadu, Kalawewa, Nuwara Eliya, Sevanapitiya and Muruthawela have produced 144.32 Mn fry in 2019. A part of these fry has been sold to Private Pond Owners (PPO), and for Community Based Organizations (CBO) managed Mini Nurseries for rearing to fingerling.

5.2. Fingerling Production:

During the year 2019, production of fingerlings recorded is 88.59 Mn in Aquaculture Development Centers (AQDCs) of NAQDA, CBO managed Mini Nurseries, cages, pens and Private Ponds. Thirty three percent of fingerlings production stated in the above were directly produced by NAQDA and balance was produced by Mini Nurseries, Pens, Cages and Private Ponds by growing fry issued by AQDCs of NAQDA.

5.3. Distribution of fingerlings:

Fingerlings produced at AQDCs, Private Ponds, Mini Nurseries, Pens and Cages were distributed amongst major aquaculture and inland fisheries development areas including, Major Reservoirs, Medium Reservoirs, Minor Reservoirs, Seasonal Tanks; Ponds/Cages/Pens, Rivers, Villus, flood plains and Lagoons. A total of 88.4 million fingerlings have been stocked during the year 2019.

5.4. Fresh Water Prawn Production (Post Larvae)

A total of 65.91 Mn. Post larvae of fresh water prawn have been issued from Pambala, Kahandamodara centers and from private hatchery.

5.5. Ornamental Fish and Aquatic Plant Farming

A tissue culture laboratory at Rambodagalla is involved in tissue culture of ornamental aquatic plants. A total of 68,524 aquatic plants have been produced and 27,000 numbers of plants were exported and 23,153 issued locally in 2019. NAQDA centers have sold 3.87 Mn worth of ornamental fish for farmers and exporters. The number of brooders sold in 2019 were 108,911.

5.6. Non- traditional Aquaculture activities

5.6.1. Sea cucumber breeding and farming

NAQDA facilitates Sea cucumber culture in pens and ponds. Farming is carried out by private sector in Mannar, Kilinochchi and Jaffna. 280 Mt (wet weight) were harvested from ponds and pens during the year 2019.

5.6.2. Seaweed farming

NAQDA facilitates sea weed farming with community participation in the Northern, Eastern and North Western Sea. Sea weed cultivation in 2019 was 247 Mt (wet) and the total farming sea area is about 100 ha.

5.6.3. Sea bass breeding and farming

NAQDA has commenced the operations at Multi-species Marine Finfish hatchery in Batticaloa. 331,000 of fingerlings have been produced in 2019. This will pave the way for expansion of Sea bass farmed in Sri Lanka.

5.6.4. Milk Fish breeding and farming.

NAQDA has taken steps to establish a Milk Fish Hatchery in Bangadeniya, Puttalam and construction is in progress. Milk fish farming for bait is carried out in Jaffna, Kilinochchi, Mannar, Puttalam Districts and 83.28 Mt was harvested in 2019.

5.6.5. Crab breeding and farming.

NAQDA has provided expertise to breed mud crabs in a private hatchery and 123,500 crablets have been produced in 2019 and the harvest of crabs is estimated at 60 Mt.

6.0 Overview of the Institution's performance and contribution to National Development

NAQDA has been identified as the apex body of Sri Lanka responsible for sustainable development and management of aquaculture and inland fisheries in Sri Lanka. NAQDA's functions include development and management of all freshwater aquatic resources i.e., inland fisheries, which are generally culture-based, and the aquaculture industry including sea farming.

Aquaculture is recognized to providing opportunities to increase food security for a growing population estimated to reach nine billion by 2050 and to meeting the challenge of alleviating poverty and addressing hunger, mal nutrition and under nutrition. Aquatic resources have a significant role to play across the food supply and value chain, linking ecosystems, economic development and human well-being. Since the contribution of capture fisheries to global food fish supplies has levelled off, aquaculture production is to be considered as a major supplier.

According to the projections, the World aquaculture production will increase to the point where it equals global capture production in near future and contributes 62% of the global supply by 2030.

In Sri Lanka, the contribution of the fisheries sector to the Gross Domestic Product (GDP) is around 1.3%. Fish and fishery products contribute around 70% to the animal protein intake of the people and is the main preferred animal protein source of the people.

The total inland fish and aquaculture production was 90,580 Mt. in the year 2019, which was an increase of 2,570 Mt. (3%) over the production in the year 2018. The inland fish production from culture-based capture fisheries in the perennial reservoirs and inland aquaculture production has increased by 5% compared to 2018. NAQDA has produced 144mn fry and 89 mn fingerlings. Mainly NAQDA's involvement in proper management of the water bodies with community participation, Stock enhancement in reservoirs have contributed for the increase of inland fish and aquaculture production.

In 2019, although shrimp production has decreased due to environmental and disease problems to 6400 Mt, there has been an increase by 14% to 6850 Mt in the total coastal aquaculture production sector. All of these achievements are backed by NAQDA's involvements in regulation, technical guidance and advisory services.

6.1. Foreign Exchange earnings and contribution to national economy

NAQDA is vested with the responsibility of development and management of inland fish production and the aquaculture industry. According to the available information the inland fish and aquaculture production is valued at around Rs.27 billion and has contributed significantly to the national economy. It is estimated that the foreign exchange earned through Shrimp exports was Rs. 3,522 Mn and Ornamental fish exports was Rs. 2,913 Mn during the year 2019.

Furthermore, freshwater prawn exports (Rs. Mn 838 in 2019), Live rock export (Rs. Mn 6.67 in 2019) are some of the new products for the export market. There is a significant contribution from coastal aquaculture exports to the foreign exchange earnings through crab, sea weed, sea cucumber, sea bass and lobster exports. All of these activities are regulated by NAQDA.

Inland fish production increased mainly due to the growth in inland capture and aquaculture where there was a significant contribution from NAQDA through fingerling production, stocking programme, monitoring fishing activities and organizing farmers.

6.2. Contribution towards Sustainable Development Goals

An aquaculture industry should develop in harmony with nature, and with the confidence of stakeholders. The 2030 Agenda is highly relevant for policy-making, planning and management for sustainable development of aquaculture. Aquaculture can contribute towards achieving several Sustainable Development Goals (SDGs). Those SDG's include SDG 1 –end poverty, SDG 2 – end Hunger and SDG -12 Responsible Consumption and Production. Achievement of SDG 14 –Life below Water (Marine resources and ecosystems), directly comes within the mandate of the ministries and agencies responsible for development and management of fisheries and living aquatic resources. NAQDA in its annual report for 2019 has stated following in relation to SDG's.

SDG 1 End poverty – NAQDA has continued livelihood development activities and in 2019, Fishermen and Farmers engaged in inland fisheries and aquaculture sectors have increased to 70,715 Nos.

SDG 2- Zero Hunger - The goal is to end hunger, achieve food security and improved nutrition and promote sustainable aquaculture. NAQDA has initiated and continued programmes to

develop culture-based fisheries and aquaculture in order to increase the inland fish and aquaculture production. The inland fish and aquaculture production was 90,580 Mt. in the year 2019 which was an increase of 2,570 Mt compared to 2018 production of 88,010 Mt. Increase in fish production Leads to increase consumption reducing mal and under nutrition in local communities.

SDG 12 Responsible Consumption and Production – Fish production of reservoirs is available fresh at landing sites of reservoirs and these fishes are sold around the reservoirs or within the villages. Excess inland fish production is transported to markets in Colombo and other urban areas as fresh fish. Excess production is processed to dried fish at village level. In 2019, dry fish production was 471 Mt and 1kg is valued at Rs. 600.00. All the fishers and farmers operate with a license, follow Best Management Practices (BMPs). BMPs are incorporated in to regulations and co-management practices are followed. The activity promotes responsible fisheries. All new aquaculture projects have to use an ecosystem approach and this will ensure the responsible farming and ultimately lead to responsible production.

SDG 14 Life below Water – Since the coastal capture fishery production is stable, the coastal production trend is in the direction of sea farming. Ecosystem approach is promoted in marine environment and environmentally friendly materials are used for farming systems. Sea weed farming is promoted in shallow sea areas improve the carrying capacity of the coastal environment. Mariculture activities are promoted and expanded considering the carrying capacity of the environment ensuring sustainability.

6.3 Financial performance

NAQDA is a government Authority with 100% capital vested in Secretary to the Treasury. The authorized capital is Rs.90 million. A financial allocation of Rs. 250 million has been made available for National Aquaculture Development Authority of Sri Lanka for the year 2019, although only Rs. 171.91 million was received from the General Treasury as capital grants. Total allocation has utilized for rehabilitation and renovation of buildings and Ponds at the Centers, rehabilitation of vehicles and equipment.

Income from sale of fish seeds, rent on leased centers and other income was Rs. 271.11 million. The Treasury grant for financing recurrent expenditure was Rs.432.90 million for the year ending 31st December 2019

7.0 Overall judgment

7.1. Institutional strengths

- Substantial institutional powers and authority vested on NAQDA by Acts No.53 of 1998 and Amendment Act No.23 of 2006 to implement its broad mandate.
- Availability of qualified, professional, skilled and trained staff in various disciplines.
- Availability of basic infrastructure to cater to the developmental needs of inland fisheries and aquaculture sector.
- Availability of a regional level aquaculture extension network to cater to the regulatory, extension and monitoring activities.
- Availability of a Management Information Systems Network in NAQDA Head office to monitor aquaculture and aquaculture extension activities in the field.
- Well established head office in a central location.
- Public confidence/ recognition.
- Positive government commitment attitude/supportive policy on aquaculture development in the country.
- Availability of complementary funding and support for aquaculture through various ministries.

7.2. Institutional weaknesses

- Inadequacy of existing capacity and infrastructure at breeding centers, to cater to the increasing demand for fry, fingerlings, post larvae and other aquaculture seed material.
- Inadequacy of research investment and research backing to the NAQDA development activities.
- Conflict of interest when performing certain activities of NAQDA in areas under the jurisdiction of other Departments and Agencies governed by different Acts and regulations, leading to conflict situations.
- Lack of technological capacities and infrastructure to breed commercially important aquaculture species in order to diversify the culture species.
- Difficulty in retaining professional staff due to poor remuneration, incentives and facilities.

- Lack of performance-based reward system, inadequacies in training opportunities for staff.
- Inadequacy in manpower.
- Substandard post-harvest handling and lack of diverse products availability to meet market demand.
- Lack of self-financed aqua farms under NAQDA for training and demonstration purposes and farmer training.
- Involvement of private sector in seed production of freshwater fish / prawn is not adequately encouraged.
- However, although NAQDA is a regulatory body, it does not have sufficient legislative power with respect to reservoir fisheries management and regulation of new areas of aquaculture.

7.3. Opportunities

- Availability of considerable aquatic resource base of fresh water, brackish water, maritime and coastal resources for aquaculture
- Trend of increasing dependency and demand on aquaculture to fulfill the global demand for fish and fishery products
- Global recognition of Sri Lanka as a quality seafood producer and a country with a significant export potential.
- Possibility of introducing environmentally sustainable production techniques. Possibilities for local and foreign investments for commercial aquaculture.
- Availability of low interest financial facilities for aquaculture.
- Increase demand for freshwater fish in the local market especially in urban areas.
- Availability of processing facility to handle processing aspects of aquaculture products.
- Availability of opportunities to develop organic aquaculture, certified and labelled aquaculture products.
- Potential to develop aqua tourism.
- Availability of opportunities to expand ornamental fish and plant culture.
- Availability of complementary funding and support for aquaculture through various Ministries and Institutions
- Employment potential for Communities.
- Possibility of diversification.

7.4. Threats

- Competition from other countries in the region having economies and productions of scale.
- Complex approval processes leading to delays in licensing process.
- Possible adverse environmental impacts due to unsustainable aquaculture.
- Increasing cost of inputs such as fish feed and drugs reducing profit margins.
- Less number of private entrepreneurs in aquaculture due to risk of business.
- Impacts of climate change on aquaculture.
- Trade barriers.
- Impact on biodiversity from aquaculture species.
- Difficulties in vesting government land for aquaculture purposes.
- Lack of the tradition of Aquaculture in Sri Lanka, making it difficult to establish new farming technologies with community participation.
- Difficulties in implementation of insurance schemes for aquaculture enterprises.
- When utilizing the irrigation water resources, higher priority is given for agriculture.
- Barriers from environmentalists to diversify aquaculture with exotic species.

8.0 Recommendations

8.1. Administrative recommendations.

- NAQDA is in the processes of getting approval for a new act "Aquaculture and culture based fisheries act". This will provide wider authority, more regulatory and management powers in the aquaculture and culture based fisheries.
- NAQDA has provided training to enhance Attitudes and Skills, computer skills, assets management skills, accounting skills etc. Foreign trainings opportunities are mainly for the Aqua culturists, aquaculture assistants and other technical officers. NAQDA should take measures to provide relevant training opportunities to employees at all levels based on a training needs assessment and ensure that such training opportunities are effectively utilized.
- It appears that promotional prospects for the clerical and allied staff category is limited. This issue to be considered in future carder revisions.
- Absence of incentives for heavy workload handled by the field level officers (Aqua culturists). Being a professional job working with live organisms, the duties of aqua culturists are not restricted to conventional office hours, but is a '24-hours a day and 7-days a week (24 x 7)' duty. There is no scheme of payment of night allowance. Aqua culturists are not paid overtime allowances but the holiday payment of 1/20th of the salary is made in lieu of working during public holidays and weekends. This payment is also restricted only to 2 days a month. Considering the views of aqua culturists, the review panel suggest to increase holiday payment at least up to 4 days a month and night allowance to appreciate their extra workload.
- The aquaculturist position is a technical position, but it is not considered as the same position which is parallel in other institutions. There is a problem of Scheme of Recruitment (SoR). Originally SoR of aquaculturist was at MA level. However, this was subsequently changed to JM level. The suggestion of the trade union was to change SoR parallel to Research Officer level at NARA.
- In the Provincial Councils (PCs), there are Fisheries Development units, where Aquaculture Development Officers (AqDOs) are appointed. Their qualifications are exactly the same as AqDOs of NAQDA, but their duties are only related to welfare of communities. However, the AqDOs of NAQDA have additional work to take legal action against people who violate inland fisheries regulations. The two parallel

positions with same qualifications have imbalance of duties having riskier duties for NAQDA officers, making them unpopular among communities compared to those in the PCs. Legal cover and protection is expected for those officers.

- For the officers at the field level, there are no fuel allowances. For many activities there are telephone conversations, but no telephone bill allowances are paid. Infrastructure facilities such as official accommodation are not adequate in many regional centers. Fuel allowance for field level officers, telephone allowance and improved accommodation facilities are recommended. There is a health insurance scheme, which is considered as a good scheme by the officers.
- Due to heavy workload, and poor working environment, NAQDA failed to retain officers, and as a result, there is a high rate of resignation. The resigned officers do not necessarily join new jobs in the aquaculture and fisheries sector. Due to resignation of officers, the workloads of remaining officers increase. However, the acting allowance paid to the officers for covering-up duties with a ceiling of one acting allowance for any amount of covering-up of duties is not justifiable.
- As NAQDA fails to retain officers, and as some regional centers are over-staffed while other are under-staffed (mainly due to political influences), the officers in the regional centers are overloaded with work. The aquaculture extension cadre is allocated at regional level is not based on the workload. For example, in the regional centers with low levels of extension work such as ornamental fish farming number of cadre positions allocated are in excess compared to regional centers in areas such as Polonnaruwa, where there should be more cadre positions. Distribution of cadres considering the work load is important.
- The transfer policy is weak. When there are duty conscious officers, they cannot get transfer to a preferred region. Presently, a new policy has been introduced to recruit persons from the area concerned. Nevertheless, such a new system should be introduced only after establishing a transfer policy for existing staff.
- There is no sufficient recognition of District Aquaculture Extension Officers (DAEOs) at regional level. As in similar sectors such as Agriculture, where such extension officers are designated as Assistant Commissioners, DAEOs requested to designate them as Assistant Directors.
- The senior level officers in the regional centers had some experience on managerial aspects including knowledge about administrative and financial regulations. However,

junior staff members do not possess such experience. Each regional center should be employed with a management assistant and a financial assistant.

- The mechanism for updating knowledge is weak. Recently, there was a symposium on inland fisheries and aquaculture. This should be continued. Workshops, training etc. should be organized.
- There are no many collaborative research projects with NARA and Universities. There is some collaboration with Provincial Councils. Private sector involvement is still very poor except for shrimp farming and ornamental fish farming. More collaborative work is suggested with different appropriate stakeholders.
- There is no efficiency bar for promoting officers so that the officers do not get a chance to improve their knowledge about administrative and financial procedures.
- In the curriculum of the diploma course conducted by the Ocean University, there are no modules related to administrative and financial management aspects. Revision in the curriculum with the consultation of stake holders is proposed.
- For law enforcement, sudden raids should be carried out. The practical difficulty is that as the assistance of Police is needed for such raids, Police needs to be informed in advance for prior arrangements. This would lead to ineffectiveness of raids in many occasions.
- Also, there is a great degree of risk involved in the process of raids. A risk allowance should be paid to the field officers, who conduct raids for law enforcement.
- Multiple uses of inland water bodies are a major issue for further expansion of culture-based fisheries. Still there is no priority for fisheries and aquaculture, which should be resolved through policy level decisions. Even under the proposed revised act, there is no provision for aquaculture extension officers to access the farmers' organizations. Only if farmers' organization agree, aquaculture extension officers are able to access them.
- Although major species used for CBF in inland waters are exotic carps, consumer preference for tilapia is greater than that for carps. Mono-sex tilapia can be used for CBF. As such, establishment of tilapia hatcheries through involvement of private sector should be encouraged.
- For freshwater prawn seed production, there are no major technical issues. However, in the development of CBF for freshwater prawn, there should be a competition for stocking and marketing so that the producers will be financially benefitted.

- In freshwater prawn hatcheries, brood stocks are purchased from fishermen and the old brood stocks are sold to the consumers. These buying and selling involve financial and administrative problems. The suggested solution is that this should be based on the prices determined by a price committee established in the provincial offices, as practiced for construction works.
- In the fisheries societies, significant amounts of funds are accumulated. However, there is no an auditing mechanism so that the sustainability of the societies is at a risk. During the periods when the fisheries societies were established under the provision of Co-operative Department, the funds accumulated were audited. A similar procedure should be revived.
- Multiple uses of inland water bodies are a major issue for further expansion of culture-based fisheries. Still there is no priority for fisheries and aquaculture, which should be resolved through policy level decisions. Even under the proposed revised act, there is no provision for aquaculture extension officers to access the farmers' organizations. Only if farmers' organization agree, aquaculture extension officers are able to access them.
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- Recruitment of aquaculturists/ aquaculture extension officers through a competitive examination conducted through Examination Department of Sri Lanka and maintenance of a merit list will help to fill the vacancies as and when carders fall vacant.
- As Government funds are limited NAQDA should consider raising more funds through other local and foreign funding agencies.
- The panel recommends that in addition to the periodical reviews, the performance of NAQDA should be reviewed annually through an internal mechanism.
- Restructure administration Division. Key officers attached under present setup are Director (Human resource Development), Assistant Director (HRD) and Administrative officer. Proposed restructuring should include two assistant directors under the director to handle human resource development separately.

- Enhance skills of the staff and strengthen the facilities at breeding and seed production centers.

8.2. Technical recommendations

- Achieving the production targets envisaged in the inland fisheries and aquaculture development plan appear to be practically impossible. For example, in the development plan it is envisaged that annual fingerling production of 50 million would be increased to 500 million within a period of 5 years.
- Fish feed is a limiting factor to achieve the production targets. Presently, there is no mechanism to produce good quality feed. Also due to the delay of import of fish feed, it is compelled to reduce the amount of feed given to fish in the nurseries. As the Government attempts to restrict import of fish feed, this situation will be further aggravated. Although import of fish feed is restricted, the feed ingredients should be imported to produce fish feed locally. The new feed mill will be established to produce tilapia feed. There is no procedure/ plan to increase feed production for carps.
- The fish seed transport facilities available in the country are barely sufficient for transporting 250 million fingerlings. The projected increase of fingerling production up to 500 million would require increased transport facilities of live fish.
- Breeding and grow out technologies for non-traditional aquaculture fin fish and shell fish species targeted to develop in Sri Lanka, are well developed and well established elsewhere. Technology transfer and adaptive technologies are required to develop in order to establish successful culture practices in Sri Lanka.
- Although major species used for CBF in inland waters are exotic carps, consumer preference for tilapia is greater than that for carps. Mono-sex tilapia can be used for culture-based fisheries. As such, establishment of tilapia hatcheries through involvement of private sector should be encouraged.
- For freshwater prawn seed production, there are no major technical issues. However, in the development of CBF for freshwater prawn, there should be a competition for stocking and marketing so that the producers will be financially benefitted.
- Diversification of aquaculture species/ system for low-cost aquaculture, non fed aquaculture and recirculation aquaculture systems are important for future sustainability.

- Regular publication of journal, Occasional papers to highlight NAQDA findings new developments. In addition, publishing regular newsletters for general public is suggested.
- Maintenance of a database/ repository. An organized data base has to be developed where all raw data is collected and stored. Access should be available to permitted users.
- Web site has to be updated regularly. Information on regional stations, available extension services, fingerling availability etc. can be informed through web.
- Provide more opportunities to officers to actively participate in local/ regional and international workshops, symposia and in conferences.
- Accreditation of PCR laboratory. The accreditation will improve the credibility of results.
- Strengthening, monitoring of the collection of fishery statistics, analysis and use of the outcome to improve the management interventions.
- Conduct regular internal assessment/ review of the work program to evaluate the relevance and the quality of the output and outcome by a committee.
- More close collaboration with NARA and Universities in identifying research gaps, and addressing research issues.
- Establishing an environmental unit to address and monitoring environmental issues related to Aquaculture and Inland fisheries.
- Ensuring more close collaboration with stakeholders, assess the gaps of value chain development of culture-based fisheries and aquaculture continuously.
- Adoption of modern technology should be in a fast track.
- Private sector and community involvement for reducing production cost, species diversification, and freshwater fish seed production should be strengthened.